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By Robert Dossie.

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Experimental and Theoretical

OF THE

SCIENCE

OF

MODERN CHEMISTRY

PHARMACY

REVISED

Containing many Experiments extremely
useful to the Student



NEW YORK

1840

THE
Elaboratory laid open,
OR, THE
S E C R E T S
OF
MODERN CHEMISTRY
AND
P H A R M A C Y
R E V E A L E D :

*Containing many Particulars extremely necessary to be known
to all Practitioners in Medicine.*



L O N D O N,

Printed for J. NOURSE at the *Lamb* opposite *Katherine-Street*
in the *Strand*. MDCCLVIII.

LIBRARY OF THE PREFACE

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THE particulars, which make the principal contents of the following pages, were known to me in consequence of some opportunities, that seldom happen to any, who are willing to impart to the public, what they learn of this kind, a minute knowledge of such matters being almost wholly confined to those who are habitually engaged in the business they relate to, and who therefore have very strong reasons against revealing them to the world, as their profits, in a great measure, depend on keeping the secret. It is not, however, hands. Nor is there indeed, any individual, among those most versed in the practice of chemistry, and pharmacy, who can be said to be acquainted with the secret, or what I have here collected, or communicated, as each has only a certain range of Arts, and is in general, engaged in the study of them, than in purely theoretical questions, which are collected by certain distinguished persons, with no deeper meditation, than of the nature of the operation, and a view of the way, material objects, have not, as is the case with the most common, been the subject of much study.

PREFACE.

THE particulars, which make the principal contents of the following pages, were known to me in consequence of some opportunities, that seldom happen to any, who are willing to impart to the public, what they learn of this kind: a minute knowledge of such matters being, almost wholly, confined to those, who are lucratively engaged in the business they relate to; and who, therefore, have very strong reasons against revealing them to the world; as their profits, in a great measure, depend on keeping the secrets of this sort, in few hands. Nor is there indeed, any individual, amongst those most versed in the practice of chemistry and pharmacy, who can boast of being acquainted with more than a part of what I have here collected, or communicated; as each has only a certain share of Arcana; and is, in general, even no further master of them, than in barely being able to perform the processes, by certain stated means; without any deeper intelligence either of the nature of the operation or subject: and some of the very material articles, moreover, have not, as far

as I am informed, been hitherto known to, or practised by, any other person than myself; though, from a very sufficient experience, I am fully convinced of their utility.

It having happened to me, however, from my indulging a great fondness for every branch of medicinal knowledge, and some peculiar circumstances of situation favourable in this particular point to my desire, to become apprised of almost all the more secret practices, used by those who prepare or vend medicines, I conceived it might be beneficial to the public to make them known; and to give the world a more just and full view of the methods, by which the greatest part of the chemical medicines to be commonly met with are prepared, than had been before done; especially, if the processes were illustrated with such observations, on the nature of the several subjects, and manner of operating, as might enable any, who would take the pains to understand what I have laid before them, to vary each process, in such manner as may suit any particular purpose or occasion; or to judge with greater certainty of the genuineness or perfection of any medicines, they may receive from the hands of those who prepare or supply them.

Others have, indeed, frequently professed, to have done the same in some degree, both in books, and courses of lectures: but they, who have been most qualified to treat these matters speculatively, have seldom had any

very accurate information of the real methods of management, in the laboratories of those few great dealers, who almost monopolize the preparation of the greatest part of the considerable articles of the chemical class of medicines: while they, on the other hand, who have been most largely concerned in the practice, have found themselves very little capable of extensive speculation; as it must, necessarily, be the result of researches, conducted by more profound and abstracted principles than come within their cognizance.

I have therefore, availing myself of the advantages, that have fall'n to my lot, with respect to both those kinds of knowledge, essayed to give a just and critical view of the present state of the operative pharmacy, especially as it depends on chemistry: and to shew, how the common preparation of medicines, particularly those of the retail chemists and druggists, who are furnished with almost every article they vend by the wholesale preparers of, or dealers in them, as also nearly the whole of what is sent into the country, differs from the regular and orthodox prescriptions. That all the persons, trading either in a more extensive or confined way in medicines, being put on the same level, with respect to the arts used in the preparation of them, may regulate their proceedings accordingly; and not lye under a necessity of reposing an implicit confidence in others; of which in general, advantages, not very fair, however customary, are taken.

In the prosecution of this design, I found it necessary, in order to the rendering intelligible what I would communicate, to go further than merely giving a history of the methods practised for the more profitable preparation or sale of medicines ; or detached observations on them. I therefore have prefixed an introductory essay, on the improvements of the instruments and general methods subservient to the intentions both of chemistry and pharmacy : as also an examination into the sameness of the real nature of several substances in the materia medica, which go under different names, and are supposed to have an essential diversity : that it may be more readily understood, on what grounds, substitutions are deemed fit to be permitted : and I flatter myself, that this part of my work may have a further benefit, than the bare elucidation of the subsequent matter ; as it may tend to inculcate a deeper knowledge of principles, which, though extremely requisite to all who concern themselves with the preparation of medicines, is yet almost universally wanting in them.

Whatever success I may have, in attempting to give new lights into the modern practice of this part of pharmacy ; I shall not, I am afraid, be thanked by those, who are most largely concerned in the preparation, or sale of medicines, for the whole of this work : as nothing can be more disagreeable to any such body of men, than to have the mysteries of their art, or trade, displayed to the world : but if they would reflect

fect what treatment any speculative person, who had made the most considerable discoveries, would meet with from them, if he endeavoured to reap a benefit from his studies, in any way where they should be concerned; they would find no room to complain, because he gave himself the pleasure of imparting, to the public, the fruits of his labour for the general good of mankind; when all other means of advantage were denied to him, through their opposition, or selfish conduct, should he go about to seek any. I could furnish very strong instances in support of the truth of this suggestion, if the common maxims of trade did not put it out of doubt.

However, the greater dealers in medicine (to all of whom, I disclaim the least obligation, and against some of whom, I have the justest cause of resentment,) may take umbrage at the liberty, I assume, of laying open the secrets of their trade, the more retail venders will, I am certain, be greatly obliged to me: since, I put it in their power either to insist, in many cases, on a more perfect commodity; or to save sixty or eighty per cent. by preparing, themselves, the same they are now supplied with; as well as to distinguish, in other articles, how far the prices, charged to them, correspond with the quality of what they buy.

But it was not for the benefit or pleasure, of either the wholesale or retail preparers, or venders of medicines, I principally intended this work: the whole body of practitioners in phy-

fic are greatly interested in this kind of information; and some classes have very little opportunity of furnishing themselves with it, however necessary. It is, therefore, to those who prescribe or administer medicines, as well as to those who prepare or sell them, I design to make this collection useful: that knowing the real manner of preparation of what they may generally meet with, as well as the common substitutions and adulterations, with the nature of each, and means of detecting them, they may guard against material impositions; and yet not give themselves the unnecessary trouble, of combating deviations from meer forms, where there is no essential reason for a strict compliance with them.

It may be said, that several of the particulars, I have introduced, are not discoveries of new matter; having been before mentioned, in the works of others, though somewhat differently. I admit the charge; but, in my justification, alledge, that few of these have been treated of, in so full and distinct a manner, as was necessary to render them useful in practice: as they have, for the most part, been only touched on slightly, in some of these voluminous complements of common processes, and trite observations on them, which have been so multiplied, that both the time lost in perusing often the same matter, and the expence of purchasing such a number of books, on the same subject, alike in the greatest part of their contents, have prevented the small portion of them, which, is new, from being

being known to many. I hope, therefore, it will be allowed, to be neither unfair or improper, to have given a place here, in a more explicit view, to such of these particulars as may be considered real improvements; even though they have been before hinted at, in the corner of some other book; and with regard to such others as concern what ought to be exploded out of practice, I have mentioned them, in order to explain intelligibly the means, by which they may be distinguished. Some things, indeed, I have found it unavoidable to take in, though without any plea of novelty; because they were wanting to complete the system, so far as was necessary for the illustration of the other parts: as, particularly, I found it necessary, in order to shew clearly the comparative advantage or impropriety of the private methods of preparing the several medicines, with the regular and authorized processes, to insert the latter; which, for the brevity of the work, I should otherwise rather have chosen to have left out. But, after all, I have been the greatest plagiarist against myself; the most material part of the theft, I have committed, being from my own performances.

There are some articles usually prepared, by those who practise medicinal chemistry, that are chiefly used by the farriers; as the crocus metallorum, and white precipitate, as made by the old processes: and there are, also, others, of which, the greatest or whole consumption is in purposes intirely foreign to medicine.

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dicine ; as the oil of vitriol, aqua fortis, yellow arsenic, &c. but I thought proper, to take them all into my collection, where I could impart any material secrets relating to them ; since it may be of advantage to those, who, by dealing in medicines, are sometimes almost unavoidably led to deal in these preparations likewise : and, as the lights, I shall give concerning them, tend also to illustrate the general principles of chemical knowledge, and the whole I say of them does not occupy any great part of the book, I hope others will excuse me.

It may, probably, be remarked, by those, who are less interested in that part of this work, which regards the teaching how to conduct the chemical processes with extraordinary profit and dispatch, that I have descended to too minute particulars ; and taken up too much room in the detail of matters, not universally instructive : especially in the observations, I have made, with respect to the operations in general, and the directions for the constructing of furnaces, and other parts of the apparatus. But those, who look into this book with a more speculative taste, must pass over this part ; and excuse it for the sake of others, who, having the advantages attending the practice more immediately in their regard, may greatly profit by it. And I can venture to affirm, that many of those cautions, which may seem most trivial on a slight view, will, on experience, be found of very high consequence in the conduct of the

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operations,

operations, where large concerns come in question: for the quantity of what is produced, as well as the reduction of the expence, are no less material, in a commercial light, than the quality. Nor is there perhaps any, that shall have occasion to build or refit an elaboratory, but who may reap a benefit by considering the instructions I have laid down with relation to the furniture of it: as they are neither founded on conjectural reasonings, nor an implicit confidence in the common usage; but on an experimental knowledge of the subject, they concern, acquired by many expensive trials of a variety of methods, aided by a close study of those principles which lead to a just theory. In giving such instructions on this head, as can at all avail in practice, it is unavoidable to be very circumstantial in every material point. For, from an ignorance of one necessary part of what is to be done, the whole may be found impracticable, to those, who have no guide but the directions before them: and I have, therefore, endeavoured to lead such, as take upon them the superintendance of this necessary work, so step by step, to the right execution of it, that, without previously conceiving what the whole structure may be when finished, they may proceed, in the due formation of the several parts, free from the least perplexity or embarrassment.

I may probably, be, likewise, charged, with not having intirely acquitted myself of the promise, implied in the title of this work, because,

X P R E F A C E.

I have concealed some particular practices, in the sophistication of medicines, which, I acknowledge myself to be informed of. But, as the design of this part of the book was, to discover and explode impositions, and not to introduce or propagate them, I thought it much better, to suppress a few of those, which are most injurious, and most likely to be pursued by persons now ignorant of them; and, instead of shewing how they may be effectuated, to teach only the method of detecting them. For I am afraid, a greater attention may be given, to what I exhibit of this kind, by those, who are inquisitive after such wicked arts, in order to reap a personal benefit from adopting them, than by those, who can have no other motives to seek this sort of knowledge, but the good the public may derive from their detecting them: and, to the latter class, it is indeed sufficient, to understand what relates to this only.

I could have written a more methodical and comprehensive treatise, on the subject I have taken in hand, had I gone into a more general disquisition of every thing relating to it: but as my design was to supply only what seemed hitherto wanting, I reduced my plan to such a form, as might best avoid the repetition of what has been already frequently said, and confined my view to such particulars only, as are either not to be found elsewhere, or would yet well bear a further elucidation. This being the sole object of my pursuit, I contented myself with the giving up the elegance

gance of the composition for the utility of conciseness ; and to place the merit of the book, rather in the choice of the matter, than the extensiveness of the plan : as I think I may safely give the readers, the satisfaction of this assurance ; that, if this book does not contain every thing relative, in a general view, to the subject, which is to be found in some others before published, it, nevertheless, contains some very material articles, that are not to be found in any.

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Page 17, line 12, for *it was therefore owing to these obscure*, read, *it was, therefore, to these obscure.* P. 137, l. 16, for *four ounces*, r. *four pounds*. P. 145, l. 16, for *spirit of alcohol*, r. *spirit or alcohol*. P. 179, l. 4, for *as well that*, r. *as well as that*. P. 197, l. 6, for *lac salphuris*, r. *lac sulphuris*. P. 198, l. 8, for *sal sulphuris*, r. *lac sulphuris*. P. 246, l. 10, for *fictitious cinnabar*, r. *factitious cinnabar*. P. 249, l. 3, for *tile be laid over*, r. *tile being laid over*. P. 253, for *cinnabar butter*, r. *cinnabar and butter*. P. 287, l. 11, for *for the solution*, r. *or the solution*. P. 304, for *fictitious Roman vitriol*, r. *factitious Roman vitriol*.

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PART I.

INTRODUCTION.

Explaining the general matters previously necessary to be known, both with respect to the operations, and subject of them, in order to the more ready comprehension of the subsequent particulars.

SECTION I.

Description of several improved parts of the chemical apparatus, conducing to the more quick and expedite manner of performing many of the processes.

THE first attention, necessary to the performing, with most ease and profit, the several operations of chemistry and pharmacy, is, the instruments employed in them ; for, on the perfection of these, depend not only the quick dispatch of the business undertaken, but also considerable savings in labour, fewel, and frequently the produce of the operation. It is, indeed, to happy inventions respecting this point, that great part of the advantage of the present practice

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tice over the former lies ; and that some few particular persons have been able to afford medicines, even though duly prepared, at extreme low prices. So that, without being well informed of the instruments, by which compendious processes may be performed, general directions, for the conducting them, would in many cases be of very little avail : and to describe the structure of each of such as serve for a variety of purposes, or to shew the principles of its general utility, on every particular occasion, would lead into a detail repetition, tediously immethodical. I shall, therefore, here endeavour, to point out all those particulars, relating to the best construction and formation of the several parts of the apparatus, which give any superiority over the common methods ; as well such as have been practised in a secret way by others, as those, which my own reasoning and experience have led me to the knowledge of ; avoiding at the same time as much as possible to dwell on any matters, which are commonly known, as my present business is not to teach the whole art of pharmacy, but only to impart those improvements, that have either been intirely concealed hitherto, or well understood only by some few.

But, however necessary it may be to the completion of my purpose, it is extremely difficult to give such descriptions in words, however multiplied, of any new parts of an apparatus, for purposes of this kind, as may enable those, who have never seen them, to conceive their
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structure and use clearly enough, to introduce them into practice ; nor do engraved designs greatly assist in this point ; for, though they convey a general idea of the figure, yet they help but little in teaching how to form or construct machines of a more complex kind. On which account, I shall endeavour, first, to lead to a distinct notion of the improvements, I shall attempt to teach, by shewing the defects and impropriety of the same subjects, according to the methods at present in use : that, by thus reasoning on what is already understood, I may facilitate the comprehension of the principles on which a greater perfection may be founded : and, having thus introduced a general notion of what I would recommend, I shall subjoin particular directions for the practice of it.

Of furnaces in general, with the defects of those at present in use.

The principal, and most critical, part of the apparatus subservient to pharmacy is, the furnaces employed for the preparation of those medicines, which come within the chemical class : as the structure of these is more complex, and the uses they are applied to of a more nice and difficult nature, by far, than any other of the operations regarding this art. It is therefore necessary, that they should be well designed, and judiciously executed ; otherwise their defects greatly enhance the expence, and frustrate the intention, of the operations they

are to perform; besides their being extremely liable to become, in a very short time, out of repair and uselessly ruinous.

It is proper, therefore, that careful and able men should be employed in the fabrication of furnaces; though such are rarely to be found among common workmen: but the most likely to succeed are those, who have either been employed before in the same business, or have been accustomed to set coppers for household purposes. When the best qualified, however, are set to work, they should be continually superintended by the operator, or some person capable of judging, both of their adherence to the plan given, and general performance of the work. For, if the parts of furnaces, that are exposed to much heat, be not made extremely compact; but are patched up of mortar and bricks, that are not fitted in every part to each other, (as bricklayers are very apt to do from the habits they acquire by being employed in coarser buildings) the mortar will very soon calcine, and shrink, in such faulty places; and make such vacuities and inlets to the air, as render the furnace incapable of doing properly its office, to the great delay and, sometimes, destruction of the process.

The materials are the next object of attention; and they ought to be well chosen, and perfect of their kind. Common bricks, with good mortar made with lime and coal ashes, well mixt and beaten together, will serve for those parts, which are not liable to be heated
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red hot; but where that degree, or a greater, may happen, Windsor bricks and Windsor loom, or Sturbridge clay, and lime, or, where the fire may be very violent, the composition, called the fire lute, (hereafter mentioned) should be used. And as the Windsor bricks are of a texture, which admits of it, they should be so worked to fit each other, as to form one compact body with scarcely any joints at all.

Particular care should be likewise taken, in the drying of furnaces. For the best designed or constructed may be easily spoiled by any mismanagement in this point; as is very frequently the case, where the use of them being wanted, as generally happens, before they are ready, they are not allowed a proper time. The interior part should be, therefore, suffered to settle and dry, for some days, before the cavity be closed in by finishing the upper: and, after that part also be become pretty firm, they should be gradually warmed by a small charcoal fire, made, either in the body of the furnace itself, or in the ash-hole under it. After this has been some time continued, and the mortar appears hard in the interior surface, a coal or wood fire may be made, of a gentle degree at first; and increased slowly, as the smoking of the furnace may indicate to be proper. But the more leisurely this proceeds, the more durable and perfect will be the furnace.

Notwithstanding the great importance of commodious furnaces to the practice of the chemical pharmacy, the methods, in general

used for their construction, are surprizingly defective: and in pursuance, therefore, of the design, I have proposed, of illustrating the directions, for the execution of the improvements I offer, by pointing out the faults in the same subjects according to the manner now in practice, I will endeavour to shew the several errors committed with regard to them; and hint on what principles they may be avoided: reserving, however, the more particular explanation of the proper remedy, in each case, till I come to give the improved plan for the construction of the several particular kinds.

The first and most obvious fault is the disposing the fireplace in the midst of the furnace, instead of putting it under the center of the object, intended to be heated. By which means, the fire exerts its greatest force on the column of brick over it; calcining and destroying all that part of the furnace, without an equivalent effect on what it is intended to act upon. This improper disposition of the fire may, however, be easily avoided, and a right situation substituted, if the worm flew be omitted; and the other methods followed, which I have given in the particular plans: and as the inconveniencies, resulting from this error, extend as well to those of stills and boilers, as of other furnaces, an undue consumption of fuel, and quick destruction of the furnace, being always disadvantageous, it will be found worth while to endeavour to remove them in all cases: especially, as it may be done without

out producing any other ; except, where immensely large vessels are in question ; which require unavoidably a support of brickwork under them.

The next fault, in the present structure of furnaces, is the want of some proper inlet for feeding the fire, without having occasion always to open the door for that purpose. For, where the fuel can only be thrown in at the door, there is a necessity for having the area of the fireplace large, otherwise a sufficient quantity cannot be made to lie in it ; as, if it be small, the coals tumble out, whenever it is filled to any greater height, every time the door is opened. Now the disadvantages, consequential to the having the fireplace too large, are manifold. For if the space, occupied by the bars, be great, and the whole area, they make, be covered with coals, the heat will be too strong on many occasions ; and, if it be not covered, a false draught is made, which greatly weakens both the degree and effect of the fire proportionably to the quantity of fuel : as the influx of the air will be the greatest through the naked part of the area, which much weakens the draught through the coals, at the same time, it greatly refrigerates both the furnace and its contents : so that, not only a great waste of fuel is made, but the latitude in the degrees of heat, and means of accommodating it to the occasion, which are to be had in furnaces well constructed, are here greatly limited. This defect may be remedied by making a pro-

per hole, sloping towards the fire, some inches above the surface of the fewel when at the highest: it must be lined with an iron frame, such as is, with its stopper, below described, and may be in dimensions about four inches long and three high; and situate in the front of the furnace, directly over the opening for the door and ash-hole. Through this hole, the fire may be fed by a shovel of a fit size and figure, or stirred with a poker properly bent, without using the door for those purposes; which need therefore only to be opened, for the making or lighting the fire, or the freeing the bars, from the scoria or clinkers, when they are choaked up with them. When the hole is not opened occasionally, the stopper must be kept in; which should so fit, as to make the side of the furnace equally intire as if there were no such hole. This manner of feeding the fire will be found a very great convenience to those, who are accustomed to it: as the effectual draught of the furnace may be thence greatly increased, the lighting the fire much facilitated, and the operator likewise enabled to have what body of fewel he pleases in the furnace, and to adequate the heat, with certainty, to any occasion, without either being subject to have the fire extinguished, when it is kept low, or not admit of being raised high, without the falling out of the coals, already in the furnace, every time he attempts to throw in a fresh supply. When this device is used, the area of the bars may be diminished at least one half;
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and the consumption of fuel will be lessened much more than in that proportion, for the reasons before given ; nor will the operation be checked, on any neglect of the operator in keeping up the fire ; as is liable to happen, when furnaces are built in the common way.

Another great error in the building furnaces, particularly those for harts-horn pots, or sand-pots, is the carrying the fire round the object, to be heated, in a vermicular flew, or worm (as it is commonly called) ; by which means, the vessel intended to be heated is much longer before it attain a due degree of heat ; as the principal force of the fire is exercised on that great mass of brickwork, which forms the worm, and is brought into equal contiguity with the vessel itself, in respect to the fire, with indeed a much greater surface exposed to it ; from whence it requires a proportionable quantity of fire to keep the whole in any stated degree of heat. Besides the great delay, therefore, in the beginning of the operation, which cannot proceed till the whole mass, that makes the worm, be brought to a certain heat, the due effect cannot be had, without the consuming a much greater proportion of fuel, than if the heated vessel hung in the open furnace. But there is yet another momentous inconvenience, arising from furnaces of this kind of structure, where a strong heat is wanted, which is, that the brickwork of these worms is extremely subject to be damaged, and fall to pieces : from whence the flew being choaked up, and the draught

draught obstructed, a necessity arises of taking down all that part of the furnace, if not the whole ; and rebuilding it at a great expence ; as there is no possibility of repairing it, under these circumstances. An intire open cavity carried round the pot, still, &c. formed by raising the brickwork, at an equal distance, on every side, and closing it in where no further heat is required, answers the end much better : suffering the proper object to be immediately surrounded by the fire ; and placing it out of the contact of other bodies, so as to be capable of being independently heated ; while the furnace itself is much less liable to be damaged, or can sustain a small degree of damage, without any material injury to its use ; and even, when it is so injured as to require repairing, admits of it with greatly less trouble and expence, than when built in the other method.

The last fault, I shall take notice of, with regard to the common structure of furnaces, is, the bad proportion of the chimnies ; which, in general, are greatly too large. By making them so, the draught is much diminished ; and the soot suffered to be collected in a troublesome manner. For, when the sides of chimnies contain a greater area of surface than can be duly heated, the necessary rarefaction of the air, passing through, is destroyed ; on which principle alone the draught of chimnies depends ; and, the cavity being too large proportionably to the current of air, the force of it is so diminished, that the soot, instead of being
blown

blown out, gathers and rests on the sides, till it obstructs the passage ; and, choaking up the draught, deadens the fire, especially at the first lighting of it ; by which means, the progress of the operation is sometimes greatly retarded. Instead, therefore, of the wide proportion now made use of, if the chimney be intended for the use of one furnace only, a square of six inches is fully sufficient ; and this may be increased, in an equal ratio, where it is designed for a greater number : and there will result this further advantage, from forming them on this proportion, that they will not require to be raised half so high, as when made in the common way.

Of the iron-work necessary to be prepared, previously to the building furnaces in general.

An iron door, with its frame, for the lighting the fire and taking out the scoria of the coals, is requisite for most kinds of furnaces : but, as such doors are commonly intended, for the further use of feeding the fire with fuel, they are made much larger than is necessary, if that method be, as I above advised, exploded. It is proper, always, to have them as long as the fireplace, or area made by the bars ; but they need not be more than four inches high, where they are not designed to serve for feeding the fire. For, the lower they are, the less they will be capable of injuring the proper draught of air, through the fuel, by making a false one : and
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the less liable, also, they will be, themselves, to warp and be out of order. They should be made of hammered iron, and strong. The usual form will very well serve ; if the latch, to keep them shut, be made bigger than common ; and carried across the whole door, to give it strength to resist the weight of the fuel ; which, otherwise, when the iron is softened by violent heat, forces the middle part outwards.

The form of the bars for bearing the fuel is, likewise, frequently faulty. The length must be always as that of the whole area of the fireplace ; but the breadth should be only a quarter of an inch : though, to give them a due strength, they may be made half an inch, or more, deep. They should be laid at a quarter and half quarter of an inch distance ; and fixed firmly into two strong cross bars at each end of them : which cross bars should be sufficiently long, to admit of their suffering the brickwork to have good hold of them ; and should be also beaten flat, at their ends, for that purpose. This fastness of the parts to each other is necessary, in order to the tearing out, with less hazard, the scoria of the coals, which sometimes choak the passage of the air betwixt the bars in a very detrimental manner : as also to make them bear to be struck when clogged with ashes : neither of which means, of assisting the fire, can be practised, in common furnaces, without some hazard of displacing the bars, and putting the furnace into some present disorder.

disorder. The bars should be of good hammered iron ; because it is difficult to procure them to be properly cast, of due dimensions, from pig iron : but if the bars and frame could be easily so procured, in one intire piece, they would answer extremely well ; especially where the heat is not so intense, as to hazard the melting any part of them.

A proper iron frame and stopper are necessary to be provided, for the hole through which the fire is to be fed with fuel, when the method of doing that by means of the door is not followed. The frame must be made of the size and form of the hole ; which, as I observed before, may be four inches long and three high ; or bigger where the furnace is large. It may be formed of four plates of a moderate strength ; of which, the two upper, must slope downwards to the fire, in the same parallel, according to the figure of the hole ; and they must also project beyond their joining with the side plates, in order to their being fixed in the brickwork. The stopper should be formed of five plates, put together in fashion of a box (as in the doors of portable iron furnaces), and of such figure and proportion as to slide into the hole, and fill it so exactly, as to render that part of the furnace intire, when it is not taken out occasionally. The hollow of this box must be turned towards the fire, and filled with fire lute ; and a handle should be fixed in the middle of the inward part, for the more commodious use of it when hot.

hot. This frame and stopper may be best made of hammered iron ; as it is difficult to procure things of so complex a form to be cast properly ; and the stopper would likewise be necessarily heavier, if made of pig iron, on account of the unavoidable thickness of the parts of cast work.

Plates, and broad bars, are also generally wanted, to be laid where brickwork is to be raised over the hollow parts of furnaces. Where larger plates are required, the cheapest and best way is to have them cast of the exact dimensions wanted : but, when a broad bar, or two, laid together, will answer the end, the easiest way is to have them cut off, of a proper length, from the bars of hammered iron, at the iron-mongers. These plates, or bars, should be procured, of a due magnitude, before the furnace be begun : the right proportion of them may be easily computed, by estimating the proportion of the parts of the furnace they are to be subservient to ; which should be always carefully done ; and the workmen apprized, by written instructions, of the size and measure of every thing, they are to erect, or put together.

Of the best manner of constructing furnaces for the sand-pot and sand-bath.

This is the most important and useful sort of furnace : which, I shall therefore treat of more particularly, because, in the usual way of building them, they are not only defective and faulty, in

all the general points before mentioned ; but in others, also, respecting the proper proportion of this particular kind. This furnace is intended to serve, for the sublimation of salts, and distillations of all kinds performed in retorts. It heats at the same time, when advantageously constructed, a sand-pot and sand-bath. In the first of which, any operation may be performed in one retort, where the degree of heat required is, from that of boiling oil to the first degree of glowing heat, or what is called red hot. In the latter may be performed any five several distillations, or distillations and digestions, where different degrees of heat are required, from that of boiling spirits of wine, to that of boiling oil ; as the bath may be made large enough to contain five retorts, or other vessels of the same magnitude ; which, by being placed nearer or more remote from the sand-pot, or fixed higher or lower in the sand, may suffer the several degrees of heat each shall require.

The first step, towards making this furnace, is, to procure a proper sand-pot, and large plate for forming the sand-bath. The size of the sand-pot must be determined, by the magnitude of the retorts, or bodies, intended to be used in it. It must be so proportioned, as to hold the retort, and to allow about two inches space for the sand to surround it on every side. The best form of sand-pots is, that of a cylinder with a concave bottom, which ought to be made double the thickness of the sides ; but the common

mon pots are generally made conical; I suppose, for the freeing them more easily from the moulds, they are cast upon; and with thin bottoms, which subjects them to be very soon worn out if exposed to a strong heat.

The plate for the bath should also be of cast iron; and must be proportioned to the size, and number, of retorts or other vessels, proposed to be worked in it. It must be long enough, to allow at least two inches space betwixt every retort, and two inches and a half betwixt them and the sides of the bath. For the breadth, the same proportion must be observed, with the addition of two inches for its bearing on the sides of the hollow it is to cover. It may be as thin as it can be well cast; but care must be taken, not to break it in the moving or fixing, which may otherwise very easily happen. A flat ring of iron of about three inches breadth, and of a proper magnitude to receive the edge of the pot into a proper groove, made in its own inner edge, should also be provided. An iron door, with its proper frames, and bars, for the fire-place, as also an iron frame, and stopper, for the hole for feeding the fire, with other bars and plates for the hollow parts of the furnace, must likewise be prepared, according to the directions above given. After which, the particular manner of constructing the whole must be as follows.

The dimensions of the furnace must be first settled, by this method; which will serve also for obtaining those of any other kind of furnace

nace designed to be built, where the object to be heated is of a constant or fixed nature. The diameter of the sand-pot, intended to be used, being first taken, six inches must be added to it, for the cavity round the pot, and the length of two bricks, to allow for the thickness of the sides of the furnace. These, being put together, give the diameter of the whole furnace. To find the due height, the height of the pot must be first taken ; to which must be added eight inches, for the distance betwixt the pot and surface of the fire when highest, six inches, for the depth of the fireplace, and eight inches, for the distance of the bars from the ground of the ash-hole, with the height of a brick, for a course that must be carried round the edge of the pot, which, being all put together, give the height of the whole furnace from the foundation.

A round cavity must then be made, in the ground, on the place where the furnace is to be erected. This must be large enough, to admit the laying the foundation of the furnace in it ; and about eight inches deep ; that the bars of the fireplace may lie on a level with the ground ; the ash-hole being below it.

The reason, for making this part of the furnace below the ground, is, to prevent the other parts from rising too high ; which is a great inconvenience to the operator, with respect to the sand-pot, when he has occasion to put a charged retort into the pot ; in doing which, he greatly loses his command of it, if the pot be placed high ;

and also with regard to the sand-bath ; which, being of course considerably higher than the sand-pot, requires, in this case, that the operator should have something to stand upon, in order to manage the full retorts put into it : an expedient to be avoided wherever it may.

The ground plan or foundation of the furnace must be laid in this hole, of dimensions suitable to the diameter, as computed by the rules above given ; and carried up of solid brickwork of a cylindrical form. But an area must be left for the ash-hole ; which must be proportioned by laying the bars, fixed in their proper situation by means of the crossbars above directed, on the ground, in the center of the cylinder ; and drawing two lines, begun at the furthest crossbar, and continued, parallel to the two outermost bars, at the distance of a quarter of an inch from them, to the front of the cylinder. The space, so described, must be left hollow ; the brickwork being carried up on the three sides of it. This may be done with common bricks and coal-ash mortar : but they must be laid solid, that the whole mass may not shrink, when the mortar shall be subjected to a great heat. The cylinder of brickwork being thus raised about eight inches high, the bars of the fireplace must be laid over the innermost part of the vacuity left for the ash-hole ; and the door, with its frame, must be also placed in the front of the bars ; (though they will not be, in this manner of construction, on a level with the exterior surface or front of

of the furnace;) and the brickwork must be again carried up six inches, in the same manner as before: only it must be made to take proper hold, both of the crossbars of the fireplace, and frame of the door. But the courses next the fire must be of Windsor brick, and laid with Windsor loom, or Sturbridge clay; and, if the heat be intended to be very violent, the joints next the fire should be pointed with the fire lute hereafter mentioned.

When the fabrick is raised to this height, an iron plate of a sufficient strength, or two broad bars, should be laid over the void part, or opening, leading to the door and ash-hole; that the brickwork may be carried intirely round above: and the cylinder must be continued as before; only the cavity must be made sloping from the upper part of the area designed for the fireplace, and enlarged in such manner; that, in raising the furnace eight inches higher, the diameter of the cavity shall be six inches more than the diameter of the sand-pot: which six inches is to allow for the three inches distance betwixt the pot and the sides of the furnace, that will here begin to be parallel. The frame for forming the hole, for feeding the fire as before described, should be fixed in the last course of bricks, which make this slope: the most convenient situation for which is; the front of the furnace, directly over the opening for the door and ash-hole.

From this height, a cylinder must be carried up, parallel to the sides of the sand-pot at

three inches distance, till within something less than a third of the top of the sand-pot ; supposing the bottom to be on a level with the foot of this cylinder : and then the hollow must slope gradually inwards, till it be no wider than just to suffer the sand-pot to be let down into it.

In the brickwork of this upper slope, must be left a cavity, for conveying the smoke and flame under the plate of the sand-bath. It must be in the center of that part, where the fabrick of the sand-bath joins the furnace ; and should be four inches and a half, or five inches, in length ; and about two inches in height.

The whole of this part of the furnace may be common brick ; but the mortar should be of Windsor loom. On the top of the brickwork, raised to this state, must be laid the iron ring or rim (before mentioned), designed to hold the sand-pot : it should be laid in with fire lute, and well pointed, with the same, at the joint it makes with the bricks within the hollow of the furnace. A proper plate should also be laid over the cavity, left for carrying the smoke and flame under the sand-bath.

When these parts of the furnace are so dried, as to hold well together, the pot should be let down into the ring ; where it must hang by its margin or turned edge ; and another course of bricks must then be raised, in a continued line with the sides of the sand-pot ; that part of them, which touches the pot, being laid in fire lute ; and the other parts in coal-ash mortar.

In this course a slope must be made, on the side opposite to the sand-bath, or front, which ever shall appear most convenient, for the neck of the retorts to bend sufficiently downwards when placed in the pot. The whole of the furnace which relates to the sand-pot being so completed, the sand-bath must be thus added.

A ground plan or foundation must first be laid; which need not, in this case, be sunk below the level of the flooring of the place: it must be proportioned according to the size of the plate intended to be used. The length must be that of the plate, with the addition of the breadth of two bricks: the breadth must be that of the plate, and the length of two bricks. It must be formed by building, as it were, four walls, that mark out this proportion; the area within them being, for the present, left hollow. This may be done with common bricks, and common mortar: only great care should be taken, the bricks may rest every where on each other, so that there may be no settling when the work shall be dry.

In adjusting the site of the area marked out for this foundation, it must be observed, to take, about three inches depth of the side of the furnace round the sand-pot, into the end of the area next it. This projection, of the one part of the furnace into the other, is necessary, in order to the bringing the end of the plate close to the flew, that is to convey the flame and smoke into the cavity under it, without being obliged to lengthen the passage; which

must otherwise be the case ; if the whole square of the brickwork of the sand-bath was built, in a distinct area, on the outside the round building for the sand-pot.

The four walls, as above directed, may be carried up ; till they rise, within the thickness of a brick, to the level of the lower part of the flew for conveying the smoke and flame : and the hollow, formed by this square of walls, may be then filled up with broken, or whole, bricks, laid firmly on each other ; the joints or interstices, betwixt them, being also filled up with dry ashes.

A flooring of bricks should then be made over this square body : they must be laid in coal-ash mortar on the under side ; and the joints on the upper side pointed with Windsor loom.

On this flooring, another area must be formed by laying rows of bricks at such distance, that the plate may rest on them one inch on each side. They must be laid crossways to each other, and for the ends next the plate Windsor loom should be used ; and for the other part coal-ash mortar : the plate must be then laid on them, and set with fire lute.

The openings at the lower ends, into the cavity under the plate, must be likewise closed up by bricks laid breadthway ; the same caution being used, as before, for the sides, with respect to the kind of mortar : but the opening of the flew, for conveying the smoke and flame under the plate, must be preserved ; as likewise another opening at the other end for the
passage

passage of the smoke into the chimney ; over which opening, a plate, or two broad bars, must be laid, to support the brickwork of the side over it.

A course of bricks, laid breadthways, must then be raised, close to the edge of the plate, intirely round it : the joints, where they meet the plate, being made good with fire lute ; but the rest with coal-ash mortar : and, over this course, as many others may be laid (but with coal-ash mortar only), as will raise the sides of the bath to a due height ; which must be regulated by the size of the retorts to be used in it.

A chimney must then be built, from the ground, close to the vent or flew for carrying off the smoke : or, if there be any other chimney within reach, a longer flew may be made, for the communication of the furnace with it ; and the erecting a new chimney avoided.

When the whole is of a proper dryness, the part of the furnace, belonging to the sand-bath ; may be plastered over with good lime mortar : but the dung of horses, which have eaten hay, should be mixed with it instead of hair, which is apt to burn in the heat it is liable to sustain here. The sand-bath must be also plastered : but mortar with hair is better for that purpose ; as, not being subject there to burn, it will hold the sides of the bath firmer together than any other kind.

It has been a practice, to put sacking over the plastering of this sort of furnaces, as well

as those belonging to the household coppers, in order to prevent the effects of a false draught through any cracks, the heat may produce in the sides of the furnace. But it is very injudicious. For, in furnaces of this kind, the sack-
ing never fails to burn ; and soon occasions all the plastering to fall to pieces ; and bring away with it the mortar ; and even, in the case of coppers, it burns near the door of the fireplace, and frequently loosens the whole sheet of plaster round the furnace.

If this kind of furnace be completed, according to the directions here given, and gradually dried, it will continue in order, if carefully used, for a long time : and when the sand-pot, which will be the first part of it, that will fail, shall become unfit for further service, the course of bricks above it being removed, it may be taken out of the ring ; and the fireplace, and other parts of the cavity, being repaired, and well pointed, a new one may be put in its place ; and the course of bricks above it restored : and this may perhaps be repeated a third time, before there be occasion, to take down any other part of the furnace.

Of the furnace for the sublimation of calomel.

This operation being, now, most generally, and indeed best, performed in mattraffes or rounds of glass, with short narrow necks, the sand-pot subservient to it must be proportionably shallow ; and the depth of the furnace cor-
respon-

respondent ; which renders it not commodiously practicable in the common sand-pots ; whose dimensions are suited to retorts and oblong bodies or cucurbits. On which account, therefore, a peculiar furnace, properly adapted to this intention, is necessary ; as the sublimation of calomel is one of the most material, and not the least profitable, processes of the chemical pharmacy.

The construction above given, for the furnace of the common sand-pots, will serve equally well for this purpose likewise : allowing for the different size of this kind of sand-pot ; which must be regulated by the magnitude of the mattraffes to be used in it. The depth of the pot should be two inches more than two thirds of the diameter of the mattraffes. For they must be placed two inches above the bottom of the pot ; and immersed about two thirds of their diameter in the sand. The breadth should be five inches more than the whole diameter of the mattraffes ; as every part of them should stand two inches and a half from the sides of the pot. The area of the fire-place need not be more than a square of six inches : and the course of bricks above the pot must be wholly omitted : nor is there any occasion, to have the lower part of the surface sunk below the level of the ground of the place ; as is required in the former kind. In all other respects, the proceedings, for the erecting this, may be the same, as has been before directed for the other.

Of the furnace for calcination, commonly called the wind-furnace.

This furnace being principally designed for operations on metals; as the deflagration of the crocus antimonij of the college, the anti-hecticon Poterij, and such others, it need not be bigger than to contain a pretty large crucible; which a fireplace, whose area is about eight inches square, will very well allow.

The best manner of erecting this kind of furnace is as follows.

First prepare a set of bars, of the proper dimensions, according to the directions above given; as also a strong iron door, with its frame, of about eight inches square: with a plate, or two flat bars of a proper size to support the brickwork over the ash-hole; and another strong one, for the same use, over the door.

A foundation or pedestal of bricks must then be raised, about three feet and a half high, and two feet square; which may be done with common bricks and mortar; and need only, indeed, be four walls; the hollow, formed by which, may be filled up with rubbish, and floored over with bricks or tiles.

On this pedestal, raise three other walls; one on each side, and one at the farthermost end, of the whole brick thickness; forming an area, betwixt them, of the length of sixteen inches, and of the breadth of eight; of which

which area, the front will be open from the default of the fourth wall.

Over this opening in the front, lay the bars, in the center of the brickwork; and place along with them a plate, that will reach from their edge to the front of the fabric, to bear the brickwork which must lie over that part of the hollow. Then carry up the sides as before, but with four walls instead of three, to inclose the area of the fireplace completely with brickwork: taking care, that the first course have good hold of the flat ends of the cross-bars.

This part must rise six inches above the bars, and then the door and frame must be fixed; and the other three sides carried up as before.

When the building is raised to the height of the door and frame, the strong plate must be laid, to bear the brickwork over it; and the brickwork must be then gradually made to converge, till it become a chimney, of which the hollow is six inches square: or it may be turned into a funnel or flew, to communicate with the chimney of another furnace, if any be sufficiently near. But, as the wind-furnace demands a very considerable draught, if the flew from it be made into the chimney, belonging to any other furnace, which may not happen to be at work when there is occasion to use this, care must be taken to stop the vent of such furnace into the chimney, to prevent the false draught; which will otherwise intirely destroy its effects on the wind-furnace.

furnace. This caution ought, indeed, to be always carefully observed, where one chimney serves for the use of two or more furnaces: otherwise much time and trouble may be thrown away, by the fire proving very unequal to the occasion.

The whole of the wind-furnace, from the bars to the top of the door, should be built of Windsor bricks, laid in Windsor loom, and pointed on the inside with fire lute.

Of retorts and receivers.

These are the most employed of any glass utensils, in the practice of modern pharmacy: having almost superseded the use of all others. Formerly cucurbits, with glass heads were chosen for many operations; and alloodials were in some cases added: but large retorts, with proportionable receivers, will better answer almost all the same ends.

The common form of retorts is not faulty; provided two kinds of them be had: the one short and thick, with very long and large necks; and the other taller, with short necks. The particular use of each of these kinds, will be pointed out, in speaking of the several operations, to which they are intended to be subservient. But it will be found very advantageous, to have a stock of both sorts ready for all occasions; and to be prepared to render the necks shorter, and enlarge their orifices, according to the designed use. This must be done

done by iron rings; whose diameter must be correspondent to the intended thickness of the end of the neck. If the ring be applied to the part where the separation is to be made, and this heated part be touched with any moisture, the piece behind where the ring has been placed will immediately fall off.

It is usual to have this done at the glass-house, before the retorts are sent from thence; but every good operator should see it performed himself, in the manner suitable to the use, the retort is to be applied to. For on the adapting properly, the size, and form, of the retort, to the nature of the operation, the success in many cases depends in a greater degree, than can be imagined by those, who have not had occasion to make accurate experiments of this kind.

Receivers should be also always had, both with short, and long, necks: it is proper indeed to have them much larger, for most purposes, than what are generally used. A greater quantity of condensing surface rendering the operation both more profitable and safe; as it prevents the forcing of the lute, and the escape of the vapour; as well as the hazard of bursting the vessels, on the raising the fire too high; if the luted juncture should hold good against the force of the expanded vapour; or the necks of the retort and receiver should fit so exactly as to admit no passage for it.

Of cucurbits or glass bodies for sublimation.

Though the most general use of retorts has greatly excluded that of this kind of vessel ; yet there are some processes, which require, that they should be retained ; as in the instance of mercury sublimate, cinnabar of antimony, ens veneris, and others. The common form is good ; but should be varied into two kinds, the one thick and spheroidal, or of a true oval form ; the other long and greatly tapering. The different use of each kind will be shewn, in treating of the respective operations, where they are to be used. A sort, with the bottom almost flat, of a small height proportionable to the breadth, and tapering so as to form a narrow neck at the top, should be also had, where camphire is to be purified.

Of tritoriums, or separating funnels.

The common figure and size of these vessels will answer the purpose, where only small quantities of the fluids to be separated are in question : but where dispatch is wanted, and the quantity large, they fail to perform what is wanted, in any efficacious manner. The greatest occasion for this kind of instrument to be rendered effectual, as to considerable quantities of fluids, is with respect to the separating the oil from the spirit of hartshorn ; as well after the first distillation from the materials, as
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the subsequent rectifications. It is there best done by very large glass funnels ; and a tin or pewter vessel, whose structure we shall here describe ; but refer, both for the use of it, and the funnels, to the process for preparing this medicine.

The tin or pewter vessel may be of a cylindrical shape, of a foot diameter, and four or five feet in length. It must be made entire, both at the top and bottom : but must have a short tube, at the top, for receiving a large tin funnel, by means of which, it may be filled ; and two other smaller tubes, in the body ; the one of which must be about a foot from the top ; and of the thickness of the little finger : the other must be about six inches from the bottom ; and of the thickness of a swan's quill. These last tubes, may be about three inches long ; and must have wooden stoppers wound about with linnen, or thread, to make them fit ; but the first tube need not be more than inch long ; and may be stopped with a cork.

Of filters.

The flannel bags, employed for this purpose, do the office very well, where no greater purification is required, than the straining thro' flannel can effect : but, where a greater clearness is necessary, paper may be used. The small glass funnels, generally applied to this end, are neither capable, with respect to dispatch or quantity, of answering well their purpose :

pose : for which reason, this operation is frequently omitted, where the quantity of fluid is great, in cases, where it might be practised with great advantage and convenience, were better methods understood. The kind of filters, I would recommend, intirely remove all difficulties in the practice of this necessary means of purification ; and may be applied, as well to the greatest, as the smallest quantities. It is an earthen cullender made of a size proportionate to the business intended to be performed by it ; and fuller of holes, which ought to be also of a larger bore, than in the sort intended for household purposes. The cullender of the largest size must not however exceed, what a sheet of filtering paper will well cover : for any greater magnitude than that would become useless. With these, must be had, also, a glass funnel, whose mouth is broader than the cullender ; and a stand of wood, by which the cullender may be supported over the funnel. Where this kind of filter is not used, in the intention of purifying any liquid body, but for separating a sediment or precipitated powder from some superfluous fluid, a linnen cloth, of the size of the paper, must be also procured.

By this apparatus, all the ends of filtering may be answered with great ease and expedition. Very large glass funnels will next suit this purpose best ; provided the paper be supported, in the hollow of the funnel, with a little cotton lightly thrust
into

into the hollow : but this method is much more precarious, as well as slower, than the other : the paper, if not good, or used with fluids of a relaxing quality, being very subject to break during the operation ; which frustrates the whole already done.

Of vessels for the chrySTALLIZATION of salts.

Very large glass receivers, containing eight or ten gallons, should be provided, and fixed in straw, in baskets, so firmly, by means of sticks or cords passed through their sides, that the glass and basket may be reversed together. Large earthen cullenders should be likewise procured with narrow bottoms for receiving the salts when taken out. This apparatus will very well serve the purpose, for common elaboratories : but, where the chrySTALLIZING glaubers, or other salts is made a particular manufacture, the following will dispatch very great quantities, with much less trouble.

A leaden boiler must be placed over a very gentle furnace ; at a due distance, from this, must be placed a leaden cistern ; for the formation of the chrySTALS, proper sized baskets must be provided, to place over this cistern, by means of a frame laid cross it, for receiving the chrySTALS when taken out of the cistern. A large flat frame of basket-work, with a rim of the same, round the edge, rising two or three inches, to prevent the salts from falling off, must likewise be made, for drying the salts.

For the chryſtallizing tartar, or making cremor tartaris, the following apparatus may be uſed, with great advantage. A large leaden boiler muſt be ſet over a gentle furnace ; to this muſt be joined two cylinders of lead, by means of two pipes, which muſt have a ſtop-cock to cut off the communication when neceſſary.

Of the apparatus for levigating teſtaceous, and other hard, bodies, where the quantity to be prepared is great.

The common implements uſed for this purpoſe, (viz.) the mortar, and levigating-ſtone and muller, are very well adapted to the end. But ſince the late attempts, made by particular perſons, to gain advantages by the preparation of the medicines of great conſumption, at very low rates, by more expedite means, a method has been practiſed of performing this operation, with much leſs labour, and conſequently greater profit, than by the uſual way.

This has been done by the introduction of the horſe-mill and roller ; which have been applied to this purpoſe, in the ſame manner, as it was before by the ſugar refiners, and manufacturers of ſnuff ; and at the ſame time that the machine grinds the materials, it alſo works the ſieves for ſearcing the powder.

Thoſe, who would diſpatch large quantities, will find great ſavings in the uſe of this method : but I think it needleſs to give a deſcription, here, of the conſtruction of ſuch

a mill ; as they, who make it their proper business to erect them, and must of course be employed for that purpose, do not want directions for the manner of making that part, which properly belongs to the mill, in the usual way : and will easily find out an expedient manner of adding the parts requisite for working the sieves, when they are informed of the use of them.

An improved apparatus, for the more commodious and advantageous distillation of volatile spirits from hartshorn, bones, or any other proper animal substance, by the use of a worm as a refrigeratory.

A large iron-pot must be first provided of the following form. The body of the pot must be of a cylindrical figure, with a concave bottom : and converging at the top, so as to make a kind of wide conical neck. Into this neck, must be inserted a tubulous arm ; which is to serve, instead of the head used in common stills, to convey the vapour into the worm or refrigeratory. The height, from the bottom of the pot to the beginning of the converging part or neck, may be four feet ; and the diameter two and a half. The length of the converging part or neck may be two feet ; and the diameter of it, at its joining with the pot, at the top or mouth of it one foot. The length of the arm may be one foot eight inches ; and the diameter of it, at its joining with the pot, four inches ; and diminishing, gra-

dually, to two inches and a half, at the other end. This arm must slope downwards, in such manner, that any fluid, which shall be condensed in it, will run out at the end : that is to say, the axis of the cone, formed by this arm, must decline two inches from the horizontal plane. The edge of the pot, at the top of the neck, must be dilated, and turned outwards : and a groove must be made in it, to receive a flat cover of lead. In the body of the pot, must be inserted, three tronions, of about six inches length : they must be strong enough to bear the weight of the pot, when it is hung in the brickwork by their means. They should be placed, at equal distances, a little below that part of the cylindrical body where the neck begins to form itself. The groove, in the neck, should be filled with a solid piece of lead exactly fitted and cemented to it : in this, another groove must be cut, to receive a leaden cover adapted to it, so as not to make a perfectly close joint ; which may be easily done, by beating the cover, after it is placed in the groove, till it fit in every part. The cover must be made of lead, about a quarter of an inch in thickness ; and a bow handle must be fixed in the middle of it.

A door and frame, bars for the fireplace, frame and stopper for the hole for feeding the fire, &c. must be provided, in the same manner as for the furnace for the sand-pot.

The foundation of the furnace must be also laid as for that of the sand-pot : only it should not

not be sunk, as in that case, below the level of the ground. For the bars of the fireplace may well be admitted to be eight or nine inches above it, without danger of raising the other parts of the fabric too high.

The dimensions of the ground plan must be thus settled. Take the diameter of the pot; and add to it six inches, and the length of two bricks.

The proceedings in the rest of the parts must be the same, as were before directed for the sand-pot: the same proportion also being observed betwixt the bottom of the pot, and surface of the fire: and likewise between the sides of it, and those of the furnace. The pot must, however, after the fireplace, and slope above it, are built, be fixed in its intended situation, with the help of props, by which it must be there supported, till the sides of the furnace be raised high enough, to take the tronions, and bear the pot. The furnace may be carried up round the pot, in a parallel form to it, at the distance of three inches: for, as the pot is hung by means of the tronions, there is no occasion for any slope, at the extremity of the brickwork, to make it support the pot; but the cavity may be closed in, by bricks laid cross, from the side of the furnace to the pot, just above where the cylinder ends. These bricks should be set, where they touch the pot, with good fire-lute; and so sloped at their end, as to suit the figure of the pot; and lie as close to it as possible.

A hole must be left in the side, just under the bricks that close in the cavity, for the communication with the chimney, which must be managed, as in the former furnace ; as must likewise the plastering, &c.

A worm, and proper tub, must be then prepared, of the same form with those commonly used ; but differing greatly in dimensions. For the pipe should be two inches and a half in diameter, and twelve feet in length. At its exit from the tub, a smaller pipe, of about three quarters of an inch in diameter, must be joined to it, in such manner, that the bore of this small tube, may be in the depending part of the bore of the large one, that the passage may not be obstructed by the joint. This lesser pipe should be about a foot long ; and must be so turned downwards, that it may go into the neck of the receiver ; or, at other times, have its orifice stopped by a cork. In the highest part of the worm, within the tub, must be likewise inserted another short pipe, of half an inch diameter, and six inches length ; in order to receive a funnel, for filling the worm occasionally with water : this pipe may have a leaden stopper fitted to it ; as it must be always closed, when there is no necessity to use it. The upper end of the large pipe, which forms the worm, must pass through the sides of the tub, as well as the lower ; and must be joined to the arm of the pot, by means of sheet lead ; which must embrace the arm, and the sides being properly sloped and soldered together,

ther, it must be brought to form a pipe, of nearly the same bore with that of the worm, to which also it must be soldered ; care being taken, that the current be preserved here as well as in the other end. The whole of the worm may be of lead, as it is much cheaper than pewter, and it will not be so corroded by the distilled matter as to occasion any inconvenience.

The tub need not be of greater dimensions, than are necessary, to suit the figure of the worm : and to contain about six inches height of water over it.

Two large receivers should be likewise provided, for containing the distilled matter, as it flows from the pipe of the worm. They should be made with narrow necks, to receive the end of the pipe affixed to the worm ; as also with a flattish bottom, and strong, in the bottle fashion, as they will stand with their necks upwards. The reason for directing duplicates of them is, that the one may be ready to be put to the worm, when the other is taken away to be emptied ; as they will be several times filled during one operation.

A tin pipe, of about half an inch diameter, and of sufficient length to pass, from the neck of the receiver, to the ash-hole of the furnace, must also be provided. To the end of this pipe, another piece of the same bore, about three inches in length, must be soldered, at an angle something greater than a right one ; being first reduced to a flattish form, except where it joins to the long pipe, so that, when the long pipe

is laid from the ash-hole into the receiver, this may go into the neck of it, along with the end of the pipe fixed to the worm ; and the remaining part of the orifice of the neck of the receiver, being luted with stiff clay, may convey, any fumes or vapour, which may remain uncondensed in the receiver, under the bars of the fire : through which being carried by the draught of air, the elaboratory will consequently be freed, in a great degree, from the powerful and offensive smell which attends this operation.

A kind of iron ladle, with a wooden handle, that will reach to the bottom of the iron pot, and to which the ladle should be fixed almost horizontally, must be made ; for emptying the pot of the remaining part of the matter after the distillation. The size of this must be determined by the neck of the pot ; to which it must be so proportioned, as to pass in and out freely.

A funnel of tin must be also provided, to fill the worm with water, whenever there shall be occasion.

A pewter alembic, for the distillation of the volatile spirit of sal ammoniacum, and the spiritus volatilis aromaticus.

This alembic must be made of good pewter : its body may be either of a cylindrical figure, or a long square, suited to the form of the sand-bath where it is to be used ; its neck should

should be about six inches high, and five in diameter, with a proper groove, to admit a cover to be put into it, so as to make a close joint with as little lute as possible. From this neck, must go two hollow arms, like that of the hartshorn pot before mentioned. They may be of the diameter of two inches, and about eighteen inches long, or as may be most convenient, to admit a receiver to be fixed to them, according to the situation where they are to be used. They must slope downwards, in such manner, that the fluid, which is collected, in them, from the vapour, may flow into the receiver. If the sand-bath, or pot, where they are to be used, stand clear of any wall, the arms may be fixed opposite to each other: but if the sand-bath be placed against a wall, so that receivers can be put on one side only, the arms may be both on that side of the alembic; but fixed to form such an angle, as may give room for the receivers to be put to them: and their length must be so proportioned, as to free the receivers from the side of the sand-bath.

Receivers must also be made, with necks suited to these arms: and they should be procured of as large a size as they can be made, preserving a proper strength.

Of the apparatus, for the distillation of the oil of turpentine.

The form of the furnace, and iron pot, above described, for the distillation of the spirit
of

of hartshorn, will equally well serve for this purpose : but the cover of the pot should have a short tube in it, by which the pot may be occasionally supplied with water, during the distillation : and this tube should have a leaden stopper fitted to it, by which it may be closed at all other times. The pipe of the worm, provided for this purpose, need not, however, be of the wideness necessary for volatile spirits ; but may be of the common form, and dimensions, used in other cases. Besides a ladle of the same kind with that directed, for taking out the remaining materials after distillation of volatile spirits, another instrument must be had, for cutting, or dividing, the remaining colophony, whether rosin, or pitch, after the distillation of the spirit of turpentine, in order to its being so divided, as to pass the narrow part of the neck : it must be formed of a flat piece of iron, half round, with a moderately sharp edge, fixed into a wooden handle, of a due length, with the round end downwards : the breadth of the iron, and the length of the handle, may be regulated, by the wideness of the neck, and the depth of the pot.

An alembic for the distillation of quicksilver.

The common instruments, directed in the books of chemistry, or used in the laboratories for the preparation of medicine, for the performing this operation, are very defective : be-
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ing either retorts, or other glass vessels, which are very liable to break, as well as the receivers used with them as refrigeratories : but the refiners, and others, who have more frequent occasions to re-purify mercury, have introduced an instrument, which answers this end with very little trouble or hazard. It is a kind of deepish pan of iron, with a cover, of the same metal, or copper, soldered on to it ; in which cover must be a short tube, for the pouring in the mercury, and taking out the recrement, or caput mortuum, if there should be any.

This tube must have a stopper, capable of being so screwed into it, as to render the joint, impervious to the vapour of the quicksilver. Into this pan, at the upper part of one side, must be soldered, likewise, a gun barrel, stopping downwards, in order to condense the vapour of the quicksilver when it rises into it. The end of this barrel must be so bent downwards, that, when the pan is placed on a common fire, it may be immersed in a vessel of water placed properly for that purpose.

An alembic for the distillation of vinegar.

This alembic should be made of the same substance as the stone-ware manufactured at Vaux-Hall. It may be round, or made, both in figure and magnitude, as may best suit the form of the sand-bath, where it is to be used. The neck must be short, and wide enough to admit the lower part of the head to pass into it.

it. It must have a head, made of the same substance as the body, and formed as the heads, made of the same earth, used for the pots, intended for the distillation of aqua fortis : except as to the size, which in this case should be no more than is necessary, to admit of two arms proper being joined to it. These arms must be of two inches diameter, at the extremity ; but larger where they join the pot. Their length, and manner of being set on the head, must be regulated, by the place where the alembic is to be used, according to the directions before given, with respect to the alembic for the distillation of volatile spirits.

The receivers should be moderately large : and their necks suited to the arms of the alembic head ; to which they are to be joined.

Apparatus, for the making oil of vitriol from sulphur.

The principal utensils, in this work, are glass globes ; which must be made as large as possible, and, according to the late improvement in the blowing them, may be of very great magnitude. The globes, having their necks cut, by a proper ring, to a due wideness, which must be regulated by the magnitude of the stopper below described, must be fixed in a proper frame, with their necks pointing horizontally : but they must be so hung, in this frame, that, on occasion, they may be so turned,

turned, as to discharge any fluid, they contain, through their neck.

The frame for supporting the globes may be of a square figure, made of wood, and of a moderate strength. The bottom must be open, so that so much of the globe may pass through, to rest upon the sand, as may be necessary to heat a gallon of water contained in it. This bottom must be fixed, with hinges, on the front side, and rest loose on the opposite, on a proper support made in the frame; so that, by means of this construction, the back part of the globe may be raised, by lifting up the back part of the bottom; and the neck made to decline so low, that any fluid contents may run out.

Spoon stoppers must be fitted to these necks, made of the same red earth, which is used for long necks. The part, that goes into the body of the globe, may be five inches long, and two and a half broad, in the form of a long deep spoon. The part, which makes the joint of the neck, must be round, and of a diameter something greater than the breadth of the spoon part; so that, when the spoon part is introduced within the cavity of the globe, this part may fill up the orifice of the neck, and prevent any escape of vapour through it.

Furnaces, with sand-pots, must be likewise provided, for the dephlegmating the oil, after it is obtained in the globes. They may be constructed in the manner before directed for

for sand-pots p. 16. and a shallow sand-bath must be likewise built, which may be made also according to the directions given before : except, that the sides of the bath need not be raised more than six inches : because the globes are only to rest upon the sand.

A furnace, with a sand-pot, may be placed at each end of the sand-bath : and a flew, in that case, may pass to the chimney, from about the middle : or, if the sand-bath can be made very long, more furnaces, with pots, may be conjoined to it, at the side ; so as to supply the heat wanted. In large works, the adjusting the furnaces properly to the number of globes, which are required to be heated, is a point of great consequence ; but cannot be regulated otherwise than by occasional discretion.

Retorts must also be provided, for the de-phlegmation. They should have large round bodies, with as low necks as possible : and the sand-pots should be adapted to their figure, by their being proportionably shallow, and wide. The receivers should be of moderate magnitude ; but blown strong, to prevent the accidents, which are liable to happen, on taking them away from the retorts and emptying them of their contents.

In the greatest work, which has been hitherto erected, the powdering the materials was performed with mortars and pestles : but it would be much more advantageous, in any large work, to employ a horse-mill, with a rolling-

rolling-stone, such as is used by the sugar bakers, &c.

Apparatus for the distillation of aqua-fortis.

A large iron cylindrical pot must be first provided. It may be three feet, or more, in height, and two feet in diameter. It must have a proper rim, at the top, with a groove, to receive the head, and admit of a due thickness of lute's lying also in the groove round it. The common figure and proportion of pots, of this kind, now made, is faulty ; they being of a conical form ; by which means, their contents in the part most exposed to the heat, are lessened, without any advantage to compensate for it : and they are also made too broad, in proportion to their height, from whence a considerable part of the effect of the fire is lost.

For this pot, a head, with two arms, must be procured ; of the form, in which they are at present made for this purpose : the dimensions must be regulated by those of the pot, as it must be adapted in the making, by means of a proper measure given to the workman, so to the size of the pot, that it may lie within the groove ; leaving room for lute to be put round it.

Receivers must be also provided, with necks proportioned to the arms of the head, which they are to receive : they should be procured of the largest size, and greatest strength possible.

Improved

Improved apparatus, for making the spirit of sulphur by the bell.

A large retort must be first provided : in whose bottom, a large hole must be made : a glass mortar must be also procured, with a concave glass plate to cover it ; in the middle of which plate, also, must be a hole ; so that any fluid, which shall fall into it, may run into the mortar. To these, must be added one of the common glasses, made, in form of a section of a cone, for drinking water ; which is to serve as a stand for a small earthen dish, for containing the sulphur. This dish must be of such magnitude, as not to fill up the hole of the receiver ; but, when placed just within it, may suffer the air to have access, and to pass, on every side, round the sulphur. To the neck of the retort, which should be long, and cut to a wide orifice, a large receiver must be fitted ; into which, when blown, must be inserted a large tube, as wide and tall as possible ; which tube must stand perpendicularly upwards, when the receiver is fixed to the neck of the retort.

This apparatus will collect much more spirit than the bells, commonly used ; and may be so managed, that the fumes may be carried off, by means of the tubulated receiver, in such manner, as to prevent, in a great degree, the annoying the operator, in that disagreeable, and

and indeed detrimental manner, which attends the other method.

An improved form, for a glass vessel, to be used for the preparation of the mercurius-calcenatus, or precipitate per se.

The most commodious figure of a glass, for this purpose, is such, as gives the largest surface to mercury contained in it, admits the air most freely, and, at the same time, excludes the dust; which, in this tedious operation, is apt otherwise to be collected. In the following these several intentions are pursued.

Let the glass be made of a conical form, terminating in a straight neck. The base of the cone may be five inches diameter; or less, in proportion to the quantity of mercury to be calcined in it. The height, from the base to the neck, may be seven inches; and that of the neck three. About two inches from the bottom, let there be two short tubes inserted, bending in a round, so that the mouths may be downwards. The top of the neck should be, likewise, so turned, that the mouth may bend downwards, to prevent its receiving any dust, or soot, that might otherwise fall into the glass among the mercury.

Of lutes.

There are a great variety of lutes in use; most of which, rightly applied, would answer
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some end ; but the art is, rather the adapting each to its proper purpose, than the forming the composition.

For the making good junctures out of the reach of a burning heat, a mixture of linseed meal, or wheaten flower, and whitening, in the proportion of one part of the first to two of the last, tempered with a solution of gum senegal in water, and spread upon the joint, a narrow piece of paper smeared with the same being put over it, and pressed close, will be found sufficient : but even the trouble of this may be greatly shortned, where the glasses fit each other well, and there is no elastic vapour to be confined, by the use of a narrow piece of bladder smeared with the white of an egg, or a strong solution of gum arabic or senegal, and fitted to the glasses over the joint.

In distillations, where the escape of part of the vapour is looked upon as a material inconvenience, it may be almost wholly prevented, by the use of quicklime well powdered, and tempered with linseed-oil, boiled till it acquire a very brown colour, (or drying oil as it is called by the painters.) But this mixture must be immediately made before it be used : and if it be employed, great care must be taken, to manage the fire, in such manner, that the vapour may not rise so fast as to heat the refrigeratory, or condensing vessels, beyond the due point : for it renders the separate glasses, joined together by it, as one intire body ; and will
resist

resist the efforts of the rarefied steam, to so great a degree, that the glasses are liable to burst before it will give way.

The occasion, where a particular kind of lute is most material, and where the most errors are practised in the choice, is, when the joints to be made good are subject to acquire a burning heat, during the operation. For here all such compositions, as owe their cohering power to animal or vegetable substances, are necessarily burnt, and reduced to the state of a mere calx. The following composition, which, for the sake of brevity, I call the fire-lute, where I have occasion to mention it, will, however, extremely well answer this end; and may be made with small expence, as the ingredients cost little, and may be prepared in large quantities ready for their being mixed together when wanted.

Take vitriol calcined to redness, and powdered, two parts, the scoria or clinkers of a smith's furnace finely levigated, and Sturbridge clay, or Windsor loom, dried and powdered, each one part; mix them well together; and then temper them with the blood of any beast; a twentieth part of their weight of short hair being beaten up with them. This is, not only an excellent lute, for all junctures of vessels where they are exposed to a great heat; but also an extremely useful cement, for the pointing furnaces, and making good all the joints of any part of them, which are liable to sustain a burning heat. It is likewise the best

composition, for coating the outsides of glass bodies, or other such vessels, as are to be used in the naked fire, where great caution against their breaking is requisite ; but, in common cases, the following cheaper mixture may be substituted.

Take of sand Windsor loom, or (if good) common loom, and dung of horses, which feed on hay, each equal parts ; temper them with water ; and beat them thoroughly together.

The last kind of lute, or cement, I shall mention, is solely, for the repairing the cracks, and replacing the broken pieces, of receivers, or other glass vessels, which admit of being used after they are in that condition ; and this, judiciously applied, in an elaboratory, where many such vessels are used, will make a considerable saving.

Take an ounce of Suffolk cheese, or any other kind devoid of fat ; grate it as small as possible ; put it, together with an ounce of quicklime, finely powdered, into two ounces of milk, from which the cream has been taken away ; mix them well, and use the mixture immediately ; spread this upon a narrow piece of linnen rag accommodated to the form of the crack ; and it will make the part equally strong, and sound, with the rest of the vessel.

SECTION II.

General observations, on the most easy and profitable methods of performing several of the operations of chemistry and pharmacy.

Of distillation.

The principal art in distillations, of every sort, consists in the chusing well the kind of apparatus for each purpose; and adapting, the several parts of it, rightly to each other. By a due skill in, and attention to, these, many operations, of a precarious nature, may be rendred assuredly successful; and great saving, in time, trouble, fewel, and the produce of the operation, may be made in the most easy and certain manner.

Spirit of wine, and all the spiritous compound waters made of it, simple waters, and essential, or etherial oils, are best managed, in the copper still with a worm, by the usual methods: except, that the making the fireplace so forwards, under the brickwork of the furnace, as is generally done, is a very gross fault. For it should be always thrown as far towards the center, as the dimensions of the body of the still will admit, and, though this is limited, in a very large apparatus, yet the fire should be under some part of the bottom

of the still, in all cases ; and as much of that exposed to it, as is consistent with the bearing, it requires to have, on the brickwork. In the case of small stills, they may be hung free of any brickwork, in the body of the furnace, after the manner directed for the sand-pots.

The distillation of acid spirits is best performed in retorts, in the sand-pot. Those, chosen for this purpose, should have a large low bulb, and a low long neck ; and be placed deep in the pot ; that the vapour, which can only be suspended in a great degree of heat, may rise over the helm ; and not circulate in the body of the retort, nor be condensed in that part of the neck, which is not depending with respect to the receiver.

In the distillations of such bodies, where two substances are put into the retort to act on each other by commensuating powers, as oil of vitriol, or spirit of nitre and mercury, and spirit of nitre and sea-salt, care must be taken, if a firm lute be used, to leave a small vent. For a great quantity of air being generated, in the action of these bodies on each other, which, from its not being capable of suffering any condensation, will necessarily force a passage somewhere, if none be left for its escape, if the lute resist sufficiently, it must consequently burst either the retort or receiver. The same caution should be observed in other operations, where separations are made of compound bodies, by the medium of others ; as also in the distillation of animal or vegetable substances, where

where they are analyzed by a burning heat. In all which cases, air is copiously produced; and will never suffer itself to be confined. From the want of knowing, or attending to, this circumstance, many operations are conducted, so as to occasion nuisance and danger to the operator, as well as loss of the distilling matter, which might otherwise be rendered safe, inoffensive, and much more profitable. Amber may be also best distilled in retorts in the sand-pot; but they ought, in this case, to have very large long necks, with a wide orifice; as well that the salt may all fix in the neck, as that it may be easily got out of it. The distillation of animal substances, where the quantity is small, may be also performed in the same manner.

The distillation of a variety of different substances is best performed in retorts, in the sand-bath, which varying in the degree of heat in the different parts, it is proper to distinguish the several kinds of substances, that may be distilled in it, into three orders. In the first may be included the rectification of spirit of hartshorn; the production of spirit of sal armoniac, either by means of fixed alkaline salt, or lime; the rectification of oil of amber; and the distillation of vinegar: for these operations, long retorts, with tall and long necks, should be chosen; for the water and crudities, being less volatile than the substance intended to be freed from them, a more perfect separation will be made, if the vapour circulate within the glass so as to suffer the water to be condensed

densed against the sides : except in the case of vinegar, where the retort should have a large bulb, and lower neck, as the acid, which is the object of the operation, is less volatile than water ; and apt to remain in the retorts, even when every advantage is taken.

In the second order may be placed *sal volatilis aromaticus*, *spiritus nitri dulcis*, *spiritus vitrioli dulcis*, *spiritus lavendulæ compositus* ; and some others.

In the last order may be put highly rectified spirit of wine, or alcohol when wanted : or the *spirit. nitri* ; or *vitriol. dulcis*, or *spir. lavend. compos.* may, on occasion, fill even the coolest part without any inconvenience. By observing this system of management, and always contriving, that every part of the sand-bath shall be employed, whenever the furnace is set to work, great savings will be made in trouble and fuel : and, though it is not easy to adapt the several operations, thus carried on together, in such manner to each other, that they may be all finished at the same time ; yet there will no inconvenience arise from that, where proper means are used. For an expert operator may, without difficulty, change the exhausted retorts for others, fresh charged, in any part of the furnace, even when it is in the hottest state ; a practice, I can assert to be extremely advantageous, and no way hazardous, when due care is taken ; though hitherto so much neglected, that I never knew it followed except where directed by myself.

In distillations, made in retorts, it is of great consequence, to have the receivers as large as possible; as it renders the operation both much quicker and safer, to have a sufficient quantity of condensing substance.

Of sublimation.

The sublimation of sal Ammoniacum, in order to produce the flowers, or the ens veneris, as also of the volatile salt, when obtained by means of chalk, is best performed, in retorts, in the sand-pot. The retorts should have large bulbs, and low, but very wide necks.

The heat of the sand-pot is also sufficient, for mercury sublimate; which may be best managed in a very large glass body of an oval figure: but this kind of furnace is not to be depended upon with regard to cinnabar, which cannot with certainty of success, be treated in any other way than in an earthen, or glass body luted, and exposed naked to the fire. In the rectification of salt of amber, sal cornu cervi, or sal volatile Ammoniacum, the sublimation may be best performed, in the second stage of the sand-bath, in low retorts, with very short necks, and wide orifices. In the sublimation of volatile salts, great care must be taken, that the heat be not too great: and if it cannot be kept under, without delaying too much the concomitant operations, in the sand-pot and the sand-bath, the sand should be removed from the retorts containing the subliming matter; and they

they should be raised higher. But a little close observation will shew the proper depth, in which they ought to be placed in the sand-bath ; and the height of the retort should be regulated accordingly : for if the neck stand too high above the sand, the salts will collect in it, and choak it up, instead of passing into the receiver.

Though large receivers are recommended for distillations, yet small ones should be used for the sublimation of salts ; as the cake formed against the top and sides will otherwise want, both that density, and thickness, which are necessary for their keeping well, and their saleable appearance.

Of calcination.

Calcination is performed on two principles, by calcfaction, that is, by the heat communicated by means of exterior fire : and by ignition ; that is, where the matter is calcined by the fire generated within itself, by means of its own combustion ; and this is effected either by admission of air to the accended body ; or by the admixture of nitre, which when used for this purpose, occasioning an explosive appearance, the chemists have called the operation, detonation, or deflagration.

Where large quantities are to be calcined by the first principle, as in the case of hartshorn, a large furnace like, in form, to that of the potters or tobacco-pipe-makers, should be had ;

or

or otherwise, where the occasion is but rare, the matter may be sent to the furnaces of that kind, and there prepared at a very small expence.

Where deflagration is to be practised, as in the process for crocus antimonij of the London-College, Antihecticum Poterij, &c. the wind-furnace must be used; and the operation performed in a crucible, raised on a small earthen stand, about two or three inches above the bars. The matter should be thrown in gradually, with great caution; especially when the crucible is filled to any considerable height; for the effervescence will frequently, otherwise, throw out a great part of the contents. But in the preparation for the crocus metallorum, according to the former processes, a method has been taken to avoid the use of any furnace, for the effecting the deflagration, the particulars of which we shall exhibit in its proper place: only an iron pot, such as is used for culinary purposes, should be provided for the performing this process: its magnitude must be such as will admit its containing all the ingredients together, which are intended to be used.

Of filtration.

Though this simple operation has been hitherto much neglected, and the common apparatus very imperfect; yet it is of great consequence, in commercial chemistry, that there should be some method, by which it may be performed,

performed, with ease and expedition, where great quantities come in question.

Filtration is generally practised, by means either of flannel cloth, or paper : for the first of which, the common method of straining through a bag of a conical form, which kind was formerly called Hippocrates's sleeve, is convenient enough ; but, where paper is required, the earthen cullenders, before described, p. 32, should be used.

As the end of filtration is of two kinds, the one to purify fluids from any solid bodies, they contain, of a feculent nature ; the other, to free, some precipitated powder or body, from the superfluous fluid with which it is mixed ; the means must be somewhat varied. In the first, paper, if it be of the right kind, is sufficient ; but, in the other, coarse cloth should be put over the paper ; otherwise, in taking the filtered mass from it, parts of it will unavoidably intermix themselves with, and incurably foul, the matter.

The manner of using the earthen cullender, is to set it upon a proper wooden stand, of a square form ; in which it must hang by its edges. Under it must be placed a glass receiver, with a large funnel of the same substance, the diameter of whose mouth must be larger than the bottom of the cullender, that the streams or drops, which fall from the holes, may be caught by the funnel, and run through its pipe into the receiver.

In setting the filters of this kind to work, great care must be taken, to accommodate rightly the paper to the cullender, as well as to pour the fluid very slowly into it at first. For otherwise, the paper will certainly burst, and delay the operation by fouling all the vessels with the unfiltred matter.

There is not any kind of paper, at present manufactured, which is so good for this use as might be : but the best, that is to be had, is the sort called bloom paper ; though even that frequently is so faulty, as not to answer, in almost any degree, the end : where it is found to be of so loose a texture, as to relax, in such manner, as not to bear the weight of the fluid, poured upon it ; or where otherwise the fluid itself is of so relaxing a nature, that it destroys the texture even of good paper ; a coarse linnen cloth must be used, along with the paper, even though the purification of the fluid, only, be the end. But in this case, it must be used differently from the manner before directed. For the paper must here be put over the cloth, instead of being under it : as the design of using both, is only to give strength to the paper.

In filtering large quantities, it will be frequently found, that after the paper has been soaked in the wet, for some time, the operation will proceed very slowly : the swelling of the substance of the paper, as well as the foulness of the fluid, diminishing, and at last choaking up, the percolating pores. In this case the
paper

paper should always be changed, immediately after the filter ceases to run moderately ; otherwise the operation would be intolerably tedious.

Of levigation.

When great quantities of testaceous or cretaceous powders are to be levigated, the most cheap and expeditious method of operation is by the horse-mills, beforementioned ; where the same machine, that grinds, likewise searces the matter.

This so much shortens the work, that the wholesale dealers find considerable advantage, in putting out quantities of materials for powders, to a person, who has erected a machine of this kind ; and levigates the several species of bodies at certain rates : but, besides the impositions, which these methods of intrusting others, with the preparation of medicines, of which the genuineness is not easily distinguished, gives room for, by exchanges or adulterations. The powders can never be made of near so great a degree of fineness, by this manner of grinding and searcing, as when levigated, by the muller on a proper stone, or marble, especially, if the following method (used originally by the preparers of colours, and called by them washing over) be superadded to the levigation.

The matter being first well levigated, or, if it be a cretaceous body broken, to a gross powder, by pounding, let it be put in a deep vessel

vessel almost full of water, and there well stirred. Then having rested a short time, that the grosser parts may sink to the bottom, let the water and finer part, yet suspended, be poured off into another vessel; and suffered to stand at rest, till the powder, poured off with the water, has totally subsided: let the clear water be then poured back, into the first vessel, with great care not to disturb the subsided powder, and let the stirring, decantation, &c. be repeated as before, so often as shall be found necessary, to separate all the powder, which is of sufficient fineness. The remaining grosser part may be again ground; and the same treatment continued, till the whole of the matter be obtained fine. By this method, executed with care, impalpable powders may be had, with great ease, from even the hardest bodies; and chalk, tobacco-pipe-clay, and such other earthy substances, as grow soft in water, may be freed from sand or other impurities, and rendered fine, without grinding.

Of chrySTALLIZATION.

Where only moderate quantities of salts are required to be chrySTALLIZED, this operation is best performed, by the large glass receivers, &c. mentioned p. 33, into which, the solution of the salts being put, and continued till the chrySTALS be duly formed, the fluid must be first poured off, into another receiver, and then the receiver and basket, containing the
cake

cake of chryftals, reverfed over the basket-work funnel, and there fuffered to remain till the fluid be drained off; the falts muft then be laid upon a board, gently floping, till they be of a proper drynefs.

Where very large quantities of falts are to be chryftallized, the leaden ciftern, &c. mentioned p. 33, muft be employed. The folution being drawn off from the boiler into the ciftern; and the chryftals, when they are formed, taken out, and put into the baskets placed over it, till the fluid be drawn from them; and then laid to dry on the flat frames of basket-work.

The great object of art, in chryftallization, is the making the folution of a due ftrength: for, if it be not fufficiently faturate, the produce of chryftals will be fmall; and if it be overcharged, the falt will fhoot fo fuddenly, that a great number of very fmall chryftals, like powder, will be formed; and coalefce, in a kind of cake, on the furface of the containing veffel; which, mixing with the larger chryftals, that will fhoot afterwards, will make them appear dull and lefs fightly. It is, therefore, very requifite to obferve the due point of faturation: which may be gained, by bringing the folution to that ftate, in which it will afford no chryftals till it be cool, and then produce, in a fhort time, fhoots like needles, inftead of the powder beforementioned: which will happen in moft kinds of falts, where the chryftals are of a long form, if the folution be charged in a

proper degree. It may be easy, for any, who desire to perform this operation with accuracy, to find out the specific gravity of the solution of each kind of salt when duly saturated for chrySTALLIZING; which, being once known, is a standard for regulating their proceedings by the most easy means. But proper allowance must be made for the season of the year; for, in summer, salts are much more disposed to shoot than in winter; and the same must be observed, likewise, with regard to the degree of heat, or cold, in the place where they stand to shoot. When from accident of weather, or situation, they are kept warm, the solution may be stronger, and much longer time must be given for the formation of the chrySTALS: the contrary will hold good with respect to winter, or accidental cold.

It may be taken as a certain principle, likewise, that, whenever salts shoot fast, the single chrySTALS will be proportionably smaller.

SECTION III.

Examination of the sameness of several substances, which make a part of the materia medica under different denominations, without any essential diversity: being necessary for the determining, how far many substitutions are allowable.

Of the sameness of all fixt alkaline salts, from whatever vegetables, or parts of vegetables, they may be produced.

The fixt alkaline salts of vegetables can be produced, by no other means, than the incineration, or burning to ashes, the proper parts of those vegetables, which can afford them. For all vegetables do not afford them, in any degree; and some, only, from certain parts. If, however, the fixt alkaline salts, thus obtained, from any vegetable whatever, be exposed to a strong and continued heat, or be deflagrated with nitre, they will be found, on the nicest examination, by any experiment, to be alike in all their qualities; except that difference, which the degree and duration of the heat, they have been exposed to, will be found to cause, promiscuously, in all.

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The supposed difference, therefore, betwixt the salts of several kinds of vegetables, as of wormwood, broom, or tartar, does not consist, really, in the salts themselves ; because, it may be destroyed by calcination in a strong heat ; and yet, there being an apparent difference, in such as have not been strongly calcined, it must necessarily arise from the admixture of some other substance, with the salts ; that is expelled or taken away by the heat of a strong calcination. This can be nothing but part of the oil of the vegetable ; which, being attracted by the salt, remains conjoined with it, even though the salt be purified by solution, and filtration ; and being thus inseparable from the fixt alkaline salt, while it remains such, by means of water or any other medium, except intense heat, appears to mark the salt with a specific character ; giving occasion to suppose, a real diversity, betwixt the salts of different vegetables, or parts of them, dependent on the different nature of the vegetables : whereas there is, in fact, no difference, but betwixt those, which have undergone incineration only, and those which have undergone a stronger, or more continued calcination ; as in the instance of the salts of wormwood and tartar. For if the salt of wormwood be deflagrated with nitre, or subjected to a strong calcination, or the salt of tartar combined with a small quantity of the burnt oil of wormwood, they will then reciprocally change their characteristic

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qualities ;

qualities; and each will acquire that, which before distinguished the other from it.

From experience, rather than philosophic knowledge of the truth of this principle, salt of tartar has been substituted, either by the prescribers or compounders, in the saline febrifuge draughts, very generally, in the place of salt of wormwood; and purified pearl-ashes are sold, by the wholesale dealers, almost constantly, in the place of salt of tartar: and where the appearance of salt of wormwood must be preserved, in conformity to the prejudice of those who have not yet got over this error, either the salt of tartar, or purified pearl-ashes, are rendred of a proper degree of foulness, to give them the brown colour of the genuine salt of wormwood; and passed for it.

The sameness of fixed alkaline salts has been, however, opposed by some persons, who, in very nice experiments, have found the salt of wormwood a menstruum for particular bodies, which the salt of tartar would not act upon, in a similar manner; the difference in these experiments does not, however, lie, in the salts, from their own nature, but in the presence of another substance conjoined with the salt of wormwood, to wit, the burnt oil of that vegetable, which aided the salt in its operation on the bodies by which the experiment was made: for freeing the salt of wormwood, from this impurity, or giving it to the other, will easily shew the fallacy of these experiments,

periments, with respect to the conclusion from them, of the actual difference of the salts.

In order to judge, nevertheless, how far the substitution of one kind of fixt alkaline salt, in the place of another, may be allowable, it is necessary to consider, whether a part of the efficacy of such salts, as medicines, may not reside in the oil, or appertain to them, in some manner, in consequence of this impure state.

With respect to the efficacy, which the oil itself may possess, when we consider it as a distinct part of the medicine, we must ascribe it to the general properties, that belong to all vegetable oils when burnt. For (as we shall see below) all vegetable oils, or sulphurs, after they have suffered the action of the fire so as to be burnt black, lose the specific qualities, they before had, as parts of the particular plant, which produced them; and acquire qualities common to them all in this state; differing only in the degree of those qualities, according to the greater or less action of the heat, and according to the other elementary substances, of the parts of the vegetables, in which they resided.

If we therefore allow, that the oils peculiar to the plants, they are obtained from, retain no specific qualities in this state; the efficacy, they may give to the alkaline salts as a medicine, must consist in those, which are common to all burnt oils. And however the property of such oils might sometimes make for the intention of the remedy, yet the small quantity, in

which they can be here administered, would take off from any stress, which could be otherwise laid upon them. But the fact is, that the alkaline and dissolving qualities of the salt are those alone, by which these medicines, in almost all cases, produce their effects; and to these the additional presence of the burnt oil is not at all necessary.

If the action of burnt oils, considered according to the small proportion of it found in a dose of alkaline salts, be insignificant, even in cases where its qualities might in some degree correspond with the intention of the medicine; and if in other cases, which are the far greatest part, it is no way relative to the intention; it remains to inquire, whether by the combination of the oil and salt, a *tertium quid*, or third kind of substance may not be generated; which may have properties different from those of the pure salt, divested of the oil; or of the oil while in its simple state.

It must indeed be admitted according to what we have said above, that the salt and oil conjoined may have some properties, different from the pure salt; but they are such as appear foreign to the apparent cause of the medicinal efficacy of alkaline salts: for, as I before observed, the quality which belongs to them, as alkalies, in destroying of acids, and checking acescence in the *viâ primâ*, (so often the cause of chronic complaints,) with their power of dissolving pituitous humours and concretions in the secretory vessels, as well by their

own saponaceous power, as by their strengthening the bile, account sufficiently for their effects, in the cure of those diseases, for which they have been hitherto administered. And it would be a presumption, ill founded, to say, that, because the action of the salt was somewhat varied, by its combination with the oil, in respect to some particular bodies of a nature foreign to those, which relate to the human constitution, (as in a very large field of experiment might be found to be equally true of almost any composition that could be made) it was therefore owing to these obscure, partial, and weak, and not their very powerful general qualities, (tho' accounting clearly for all the particular effects,) they owed their medicinal operation.

It may therefore be deemed an allowable (that is to say, with respect to the medicinal effects, an innocent) substitution, to use the fixt alkaline salt of one vegetable, or part of a vegetable, for that of another: provided there be no impurity, or defect as to the general nature, in the salt so used: and it would be much better, in order to avoid impositions with respect to price, and those other frauds of the same kind, with which the present practice is greatly replete, that the college would establish this doctrine in their pharmacopeia; and prescribe only fixt alkaline salts in general: leaving it to those, to add the burnt oil of wormwood, or any other vegetable, in their extemporaneous prescriptions, who may think it apposite to the particular intention of cure.

Of the sameness of volatile alkaline salts, from whatever animals, or parts of animals, they may be produced.

What is above said of the fixt alkaline salts of vegetables, is equally true of the volatile alkaline salts of animals. For, nature having formed all these kinds from the same elements, those combinations, which give the specific form to each, are destroyed by the resolution made by fire or putrefaction; and new ones are produced, not according to those modes of combination, which the fire destroyed, and which are producible only by the power of vegetation; but according to the general qualities of the elements, and their proportionable quantities to each other.

This will be found true, with respect to volatile alkaline salts, by experiments made on the same principle with those beforementioned, for proving the sameness of the fixt alkaline salts. For, if volatile alkaline salts be so purified by rectification, or any other method, that the oil be intirely taken away from them, they will appear alike in all their qualities; and, also, if the oil of one kind be added to the other, in a pure state, it will resemble that intirely from which the oil was borrowed. As, for example, if salt of hartshorn be commixt with spirit of salt, and consequently formed into sal Ammoniacum, and the volatile salt afterwards again separated, by the addition of fixt alkaline salts,
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it will be found, then, to be the same in every point, as if separated from the sal Ammoniacum brought from the east : or, if to the volatile salt of sal Ammoniacum, obtained from the eastern kind, the oil distilled from hartshorn be added, the salt will perfectly resemble that extracted from the horn.

With respect to the pure volatile alkaline salt of any animal, or part of an animal, the volatile salt obtained from sal Ammoniacum might well be substituted ; and the same holds good with regard to what is called volatile spirit, which is, in fact, only the salt dissolved in water : but those, which are used in medicine under the name of particular salts or spirits, are greatly replete with the distilled oil, that arises along with the salts ; and which is not, as the burnt oil in the case of the fixt alkaline salt of vegetables, either irrelative, or inadequate to the intention of the medicine ; but, on the contrary, a proper and essential part of it : and therefore volatile spirit of sal Ammoniacum, cannot be substituted for spirit of hartshorn, without a material defect ; unless an equivalent quantity of the same kind of oil be previously conjoined with it. But if a volatile spirit, or salt, be drawn from any other sort of animal substance, and be replete with an oil of the same kind, in a state equally, or more, suitable to the intention of this medicine, they may well be substituted for those of hartshorn, vipers, or any other particular materials, which the fancy of persons ignorant in principles of this kind
may

may direct. And the substitution of any other volatile spirit, instead of spirit of hartshorn, provided it be duly replete with volatile salt, and distilled animal oil of the more ethereal kind, may indeed be considered as a fraud in commerce, but is in fact an improvement in medicine.

Of the sameness of oils, distilled from the several kinds, or parts of animals.

There is no part of any animal, which will afford an oil by distillation, till the same be burnt, and the oil rendered ethereal by heat: yet, nevertheless, not only the adipose, or fat parts, but even any other, if they be exposed to a certain degree of heat, necessarily afford an oil which rises from them, in the state of vapour; and may be collected by proper condensing vessels. In this burnt state, the form and specific qualities, which the oils might have in their original state, are lost; and, like fixt or volatile alkaline salts, they put on a general nature, which has no dependance on, or affinity with, the specific qualities of the animals, or parts, whence the oils are extracted, but is similar in all.

There is, however, a variation in distilled oils, not found in alkaline salts; though none arises from the peculiar qualities of the animals, or parts that afford them; for, in all the several parts of animals, the sulphureous principle, or phlogiston, which is the proper essence of all oils, is more strongly combined, in some of the substances, which constitute those parts,
with

with earth and acid, than in others; and, being thus attracted by the earth, or reduced by the controlling power of the acid nearer to the state of a fixt sulphur, raises with itself, in the distillation, a greater proportion of these heterogeneous bodies; and, consequently, produces a grosser and less volatile oil; in which, the heat not having made a more perfect resolution of the elements, it is yet subject, in some degree, to that tendency to the putrefactive analysis, that is common to all the parts of animals: while, from other substances, in which the phlogiston is less intangled with the earth, or acid, the oil rises of a more pure, simple, and, consequently, unchangeable nature; having that greater degree of lightness, volatility, and limpidness, which brings it to what is called the ethereal state.

The difference, therefore, in oils distilled from animal substances, not arising from any difference of the kinds of animals, or parts of them, whence they are obtained: those extracted from one kind may be, with propriety, substituted, for those extracted from others; provided the general qualities of such oils, be such as are best suited to the particular purpose then in question. And though the knowledge of this principle concerns not greatly the practice of medicine, with respect to the use of the oils in their simple state, as they are seldom so administered; yet, as the presence of such oils give in part the efficacy to some generally esteemed capital medicine, as well as to others, celebrated by particular

ticular persons only, it was necessary to be understood, in order to judge of the allowableness of certain substitutions we shall have occasion hereafter to speak of.

Of the sameness, in quality, of the burnt oils of vegetables, from whatever kind produced.

What has been before said of the alkaline salts, and the distilled oils of animals, is equally true, with respect to the burnt oils of vegetables : for the fire intirely destroys those combinations, on which their specific form and properties, in the plants, depend ; and produces such, as relate only to the general properties and proportion of the elements, of which all are constituted. Where, therefore, any supposed difference, in medicines, lies in the burnt oil, it may be concluded of no consequence ; nor does it matter from what different vegetables, or parts of them, any such medicine be prepared ; but one may equally well be substituted for the other, if the form and general qualities are correspondent in each. This must not, however, be understood to extend to such oils, as subsist, in an ethereal or essential state, in the vegetable ; and may be obtained, by distillation, with less than a burning degree of heat.

*Of the sameness of the calcined earths of all animal,
and vegetable, substances.*

The earth, which makes the basis or solid part of all animal and vegetable substances, is of one kind; and is never so changed, by its combination with other bodies, but that a perfect calcination will reduce it again to its original state.

This being admitted, it results, that the several testaceous or calcined earths of animals or vegetables, used in medicine, can be no ways different, with respect to the earth itself: but that where there is a real diversity, it must be owing to the presence of some other substance. In those, which have undergone no calcination, or but a slight one, a greater or less proportion of the animal gluten, or oil which formed it, will necessarily be found: and, in some, where the calcination is more perfect, the substance, which gives quicklime its peculiar action, will be generated; as in the case of the oyster shells. But, if the calcination be perfect, and the calcareous gas be separated by frequent ablutions, the earth will at length be found the same, in every instance.

The testacea, therefore, in all which, there is some quantity of the animal gluten, though the proportion be different according to the different tenacity of each kind, may be substituted for each other; as there is no diversity in them, but what relates to the proportion of gluten; and consequently not to the qualities of the earths,

earths, on which their medicinal virtue depends; that is to say, to their power of absorbing, or more properly neutralizing, acids.

The animal and vegetable earths of all kinds, perfectly calcined, may likewise be substituted for each other: if the quality, peculiar to quick-lime, be not wanted; and those, in which this quality may be found, be freed from it by washing.

But, where calcined animal substances are to be used as lime, there will be found an essential difference, in the produce of the calcination, with respect to different kinds; which difference, though not really existing in the earths themselves, but caused by their combination with another substance, yet being necessary to the intention of the medicine, renders it proper, that the particular kind of animal substance, prescribed, should be strictly adhered to. For, if the question should be, with regard to the substitution of calcined hartshorn for oyster-shells; we should put a substance that wants, or but in a very small degree possesses, the peculiar quality of quick-lime, for one, which has it in a very great degree.

It is usual to substitute chalk for all the testacea, and calcined earths of parts of animals; but this is by no means allowable: for there is not only an essential diversity, in the medicinal qualities, betwixt fossile earths, and those of animal or vegetable substances; but even betwixt almost every different species of the fossile earths themselves: and though the alkaline

line qualities of the chalk gives it a great affinity to the animal earths, as operating in the same intention ; yet an astringent styptic quality, superadded to its alkaline, renders it, in some cases, by no means a fit substitution for the testacea.

Of the sameness of vinous spirits, from whatever materials obtained.

As nothing can produce vinous spirit, but the saccharine juice of vegetables, changed by fermentation ; so, when that change is made, there is not the least difference betwixt the spirits produced, from whatever vegetable, or part of a vegetable, they may be obtained.

This will be evident, on a high rectification of any kind whatever ; for the alcohol will appear the same, even on examination by the nicest experiments.

The difference, therefore, of those kind of vinous spirits, which go under different names, is not in the spirit itself, but in the admixture of some quantity of the essential oil of the vegetable, or particular parts of them, which arises in the first distillation, together with the spirit ; as in the case of rum : and sometimes also in the admixture of the acid of the fruit, which, coming over with it, dulcifies the spirit, in the same manner, as other acids ; as in the instance of brandy. But the manner of counterfeiting the peculiar qualities of the several kinds, as well as the destruction of them, when
natural,

natural, by repeated distillations, all evince the diversity not to lie in the spirit itself.

In tinctures, therefore, and all cases, where the flavour is regarded, the kind of spirit prescribed ought to be used ; to render the medicine what it is intended to be : but, where a subsequent distillation is to be made, or where the flavour is covered by the admixture of drugs of very strong taste, any kind of spirit may be used, without the least injury to the composition : and, indeed, with respect to the medicinal efficacy, it is matter of indifference in all cases.

Of the sameness of the acid spirit to be obtained, from sulphur, vitriol, sal catharticum amarum (commonly called Epsom salt), and alum.

The acid gas commonly called oil of vitriol, or the vitriolic acid, has been formerly supposed to be peculiar to the salts of the vitriolic genus; and not, elsewhere, to be naturally found: but later experience, and more rational inquiries, concerning subjects of this kind, have informed us, that it is absolutely the same with the acid obtained from sulphur by burning: and the one is now promiscuously substituted for the other; or rather, the acid of sulphur is now almost universally sold for, and under the name of, the other: as, by the late improvements of the methods of distillation of it, this acid can be extracted, much more profitably, from sulphur than vitriol.

The acid part of the *sal catharticum amarum*, and alum, is also the same with that of vitriol and sulphur: and though it is rarely distilled from them, as it can be cheaper obtained from the other bodies; yet the salts themselves may be, occasionally, used, for neutralizing fixt alkaline salt, and forming the *sal polychrest*, or vitriolate tartar; as it may be depended on, that whatever acid is imparted, to any other body, from sulphur, vitriol, *sal catharticum*, or alum, is absolutely of the same kind.

Of the sameness of vitriolated tartar, sal polychrestum, sal prunellæ, and the sal enixum.

The vitriolated tartar, being immediately made by the admixture of vitriol, and fixt alkaline salt, and the *sal polychrestum*, being formed from nitre, and sulphur, deflagrated together, the acid of the sulphur being set loose in the deflagration to act on the alkaline basis, which is fixt alkaline salt, it cannot be denied, but that, if the acids of vitriol and sulphur be the same, as we have before laid down, and that the acid of the sulphur combine with the alkaline part of the nitre, as is evident, the salt produced by each method must be the same: there being no difference in effect, whether the elements are mixt simply together, or combined after their separation from other bodies, with which they were conjoined, in the manner that happens in the deflagration; where the proper acid of the nitre, and the phlogiston of the sulphur

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flying away, in the explosion, leave the acid of the sulphur, and the alkaline part of the nitre, at liberty to act on each other.

The sal prunellæ, as made according to the former, and most general processes, is exactly the same as the sal polychrest: equal parts of nitre and sulphur, being ordered to be deflagrated together for the first; and as much sulphur, as will deflagrate with the nitre, for the other: only the sal prunellæ was cast into cakes, and the sal polychrestum chrystallized. There can remain no doubt, therefore, of their being the same with each other; and with the tartar vitriolate.

The college of Edinburg have, indeed, after Lemery, ordered the sal prunellæ to be prepared with a much less quantity of sulphur, than is sufficient to analyze all the nitre, by deflagration; and the sal prunellæ, so made, will, consequently, be a compound of nitre, and sal polychrest: but this method of preparing it has, I fancy, prevailed very little hitherto: the processes of Quincy's Dispensatory, and the other older books, being most generally followed with regard to it.

Sal enixum being formed by the addition of oil of vitriol to nitre; which oil of vitriol disposes the proper spirit of the nitre of its alkaline basis, and combines with it; and this alkaline basis being, as was said before, fixt alkaline salt; it is evident that this salt is the same with the vitriolate tartar, sal polychrestum, and sal prunellæ: being, like them, formed only
of

of fixed alkaline salt, neutralized by the vitriolic acid.

All the above mentioned salts, therefore, or any other preparation of fixt alkaline salt, and the acid of sulphur, vitriol sal catharticum, or alum, in which a neutral salt is formed, may be fairly substituted for each other. The elements being, in fact, the very same: but the residuum of the nitre and oil of vitriol, in the distillation of spirit of nitre, which is sold most generally in the shops under the name of the vitriolate tartar, must be excepted, till it be duly neutralized, for it commonly abounds with a great quantity of redundant acid left behind with it in the retort after the distillation.

PART II.

Of the preparation of chemical medicines : with the several substitutions and adulterations practised in relation to them ; as also the best means of detecting such practices.

SECTION I.

Of the preparation of those medicines, where saline substances make the whole, or principal part of the subject.

Preparation of spirit of hartshorn.

LET pieces of hartshorn be distilled, with a fire gradually augmented, almost to the greatest degree. Spirit, salt, and oil will arise : and, the oil being taken from them, let the spirit, and salt, be mixt together again ; and distilled with a very gentle heat, and they will both rise purer : which operation being several times cautiously repeated, and a proper part of the salt taken away to be reserved for sublimation, the spirit will become limpid as water, and have a grateful smell.

Note.

Spirit of hartshorn is one of the capital articles of the chemical pharmacy, and has undergone a greater revolution, in its price, and manner of preparation, than any medicine whatever. A few years ago, the lowest rate it was sold for, in the most wholesale way, was half a crown, or three shillings per pound : it has since been reduced to the low price of five pence or a groat ; at which rate, a great part of the consumption has been supplied, by the preparers, to the wholesale dealers. This is done by an intire substitution of other volatile spirits, distilled from substances much cheaper than hartshorn : and by the treating even these in such a manner as disguises their real strength ; and makes even very weak pass for extreme good spirit of hartshorn, though sold as at this excessive low price : whereas genuine spirit of hartshorn, prepared as the above process directs, can never be afforded with reasonable profit for less than two shillings per pound.

It is not, however, essential, that this medicine should be prepared from horn ; but rather improper : for volatile spirits, obtained from this substance, however often they may be rectified, at least within any moderate compass, are apt to grow brown, foul, and foetid : so that, if kept for any length of time, they become nauseous and unsightly : whereas, if distilled from bones properly prepared, they require
much

much less rectification ; are more palatable and grateful to the stomach ; and will retain their limpid and colourless appearance for a considerable duration, a quality very valuable to apothecaries, especially those in the country, who cannot be continually renewing their stock.

The redundance of, and unfavourable quality in, the burnt oil of horns, to which this unfitness to produce good volatile spirits is owing, arise from the great quantity of the animal gluten which all corneous substances contain : this gluten abounding in all parts of animals in proportion to their tenacity ; of which indeed it is the cause : and being, in fact, nothing but oil mutually attracting and attracted by the earth, which constitutes the solid basis of the parts.

If we admit all volatile salts to be the same ; and consider, that this compound, we call spirit of hartshorn, consists of water, volatile salt, and distilled animal oil ; we shall see, that, as no difference can lie in the volatile salts, or water ; it must, if there be any difference at all betwixt this spirit, and that distilled from any other animal substance, be in the oil only.

Now all distilled oils of animal substances, being likewise of the same nature ; except that, by the action of the fire, some are higher exalted, and gaining a more ethereal nature, become less liable to putrefaction ; while others, being less changed from their original grosser state, retain some tendency to putrefy ; it must appear, that there can be no difference in volatile spirits, but in their being charged, in a

greater or less proportion, with oils that vary only in their exaltation, or approach to the ethereal state ; in the greater degree of which, consists their medicinal excellence : as may be easily granted, when it is considered, in what intention they are taken. If, therefore, it should be manifest, from experiment, that volatile spirit, extracted from prepared bones, or any other animal substance, contains a more ethereal oil, than spirit drawn from hartshorn ; it must consequently be concluded to be a more efficacious medicine, as well as a much more grateful and convenient one, on the account above mentioned.

Dr. P, in his notes on this article, in the translation of, the College-Dispensatory, seems to think, this spirit should be divested as much as possible of the oil. For he places the perfection of the preparation in the number of rectifications ; and on this principle, half a guinea an ounce has been charged for some quantities, supposed to be thus improved. But certainly there are limits to the proportion of oil that should be thus separated from the spirit : for if no oil were necessary to the constitution of the medicine ; but that a pure volatile salt and water made its proper contents ; it might be much better prepared, by making a solution of volatile salt of sal Ammoniacum in water ; or distilling such a spirit from a solution of sal Ammoniacum with salt of tartar : but the true composition of it, is not, from volatile salts and water alone ;

lone ; but from these with the addition of ethereal animal oil ; which makes, with the others a volatile sapo : the oil being evidently an ingredient, correspondent to the intention, equally with the volatile salt ; as may be gathered from its affinity with other ethereal oils, as of amber, or the aromatic vegetables, &c. Which-ever of these notions we adopt, the spirit of bones seems still preferable to those of horn : and we shall principally inquire, how that can be best and cheapest prepared : but for the sake of those, who adhere to the old faith, as to the superiority of the true spirit of hartshorn, to other volatile spirits distilled from other animals, or parts of them, I shall first make some observations on the regular process above given, and the best manner of performing it : pointing out, also, the defects of the apparatus generally used ; and shewing how they may be best amended.

The pots, in which this distillation is made, are much too small ; being, in general, made to contain only three quarters of a hundred weight of the horn : whereas, with the same fire and trouble, double or treble the quantity might be distilled together, in larger pots. The reason for this unprofitable manner of working, has been the difficulty found in forming a proper apparatus, for condensing the distilled vapour, when raised in a greater quantity than three quarters of a hundred, or a hundred weight of materials would afford. The most general way has been to use, as a refrigeratory, only a series of glass allodials luted together,
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and terminating in a glass receiver : but later improvements have introduced the use of a long tin tube, joined to the pot by one or two allodials placed next the pot, passing into a large earthen or stone jar, made close at the top, and venting itself again by another tube of the same kind, terminating either in another such jar, or a large glass receiver.

This has been found much preferable to the first method, of using glass allodials alone ; but both of them are far inferior to that described in the next process.

By the best of these methods, six or eight days are required, from the charging the pot, to the finishing the operation : for a considerable time is taken up, for the drying the lute ; which is with much trouble laid on, and repaired, at so many different junctures : and, when this tedious part of the work is finished, the fire must be very well regulated, otherwise the lute will be blown off, the stench become intolerable, and a very great waste made of the produce of the operation ; indeed a considerable waste, and a very bad smell, will always attend this manner of working, even when best managed. There is indeed a way, that has been hitherto overlooked, from the almost universal ignorance in principles, of persons concerned in these operations, of preventing greatly the smell and waste with the worst apparatus. For the force on the lute, being, in a great degree, owing to the air generated in that analysis, which the fire makes of the elements

ments that compose the substances distilled ; which air being incondensible, as well as highly elastic, must somewhere find a vent, as its quantity augments ; this air straining the lute, cracks and opens it ; and pressing out through these cracks or openings, drives with it, likewise, the condensible part of the vapour, especially about the head, and first allodial, which are replete with such vapour ; because the heat prevents almost any condensation from being performed there. If, therefore, a proper vent should be made in the receiver, or some distant part of the condensing vessels ; by means of which, the lute may be kept free from its efforts, and remain intire : the rivus of air would pass forwards to the vent of the extremity of the surface, and drive along with it the condensible vapour that forms the distilled spirit ; which thus coming, in its passage, in contact with the refrigerating surface of the vessels, will be for the most part condensed, and not blown out through the cracks, otherwise produced in the lute. This vent may be likewise carried into a small tin pipe, communicating with the chimney, or ash-hole ; by which means, both the laboratory, and places contiguous, may be kept free, in a great degree, from this troublesome smell.

It would be much better, however, in all cases, to use the worm, as a refrigeratory, in the distillation of hartshorn ; according to the directions given below : for though the salt would not be obtained, in this part of the process,

cess, in such proportion as when allodials are used: yet a considerable quantity may be taken out of the receiver, used in such distillation; and what more may be wanted, may be got out of the receivers, used in the rectification; if they be taken off before the spirit begins to come over and wash the salt off the sides: and the salt procured by these methods, will be much freer from oil; and, consequently, much less troublesome in rectifying, than that taken out of the allodials: it being exactly the same, in the result, which way it is separated from the distilled spirit; as there will the same proportionable quantity remain in it after what is taken.

Another defect in the common management of the genuine spirit of hartshorn, is, the want of a more commodious method of separating, immediately after the distillation, the foul oil, which comes over with the spirit and salt, and causes a considerable waste, when taken out by the methods now used: and, which not being very efficacious in freeing it from the oil, occasion the spirit to be injured by being kept too long commixt with what is left floating upon it. This may be best remedied by employing the tritorium described in the introduction, in the manner below ordered; and treating the spirit according to the subsequent directions there laid down.

In the process of the college above given, the salt is ordered to be rectified along with the spirit, before its being taken away to be sublimed;

limed; which is one of the most effectual methods of giving it some degree of purity. But the more common way, is to separate it from the spirit, immediately after the distillation from the materials; by which a considerable delay is avoided in the rectification of the spirit.

The number of rectifications intimated to be necessary in this process, are likewise frequently curtailed: though, in order to the making the genuine spirit keep tolerably, there ought to be four, and these performed at some distance of time from each other; the oil swimming on the surface of the fluid being carefully separated after each: for fewer rectifications, performed at intervals of some length, will render the spirit more pure than a greater number, quicker repeated: as the oil can be much more copiously separated, from the spirit, by rectification, after the natural separation of it by its own tendency, which shews itself by a turbidness and sediment, than, while they remain more perfectly united, as in the limpid state they are found to be, for some time after each rectification.

Method of making spirit of hartshorn, fictitious, with respect to the materials, but perfect, with regard to the qualities correspondent to the intention of medicine.

Take any quantity of the bones, from whence the fat has been extracted, by those who

who collect them for that purpose : distill them, and rectify the salt and spirit together, taking out a proper quantity of salt, which will rise before the spirit, by changing the retort before the salt be melted by the spirit : rectify the spirit twice more ; and, after keeping it for some time, filter it through paper.

Note.

These materials, both from their own nature, and the previous preparation in the freeing them from all oily substances, by the long boiling, practised by the people, who collect them, are the best and cheapest materials, from whence this spirit could possibly be drawn : they may be purchased, in London, at five shillings per ton ; and they afford a very pure spirit, with very little trouble, as I have before mentioned.

The distillation should be performed in the pot, with the worm and other parts of the apparatus, as described p. 35, into which, being put, and the cover placed on it ; which, without lute, will make a close joint, the distillation may be immediately begun ; and will be over, with proper management, in sixteen or eighteen hours.

The end of the bending pipe, added to the end of the worm, for that purpose, must be let into the neck of a large receiver placed under it ; and the tin pipe, for carrying off the smell, should also have its bending end put into the neck of the receiver ; and the remaining opening of the mouth may be made good, by some moist, but stiff, clay.

When the receiver appears of a proper fullness, it should be taken away ; and another put in its stead, in the same manner as the first ; and this should be repeated as often as they fill. The receivers should be emptied, by means of a tin funnel, into the tin or pewter tritorium described p. 30 ; and the crude spirit kept there till it be wanted for rectification ; or, if the tritorium will not contain all that may happen to be made, this spirit may be drawn off, from it, into a proper bottle, to make room for the fresh, through the lower tube, which alone must be used for this purpose ; the upper one being designed for drawing off the oil, which will float on the spirit, and may be easily taken away from it, by this method, when there is a proper quantity in the tritorium, and the spirit raises it to a proper height.

If, as will sometimes happen towards the end of the distillation, the worm should be so choaked up with the salt, arising along with the spirit, that the passage of the vapours may be obstructed, which may be perceived by the appearance of the smoke through the juncture
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of the cover and pot, the stopper should be immediately taken out of the small pipe in the upper part of the worm ; and, a small tin funnel being put in it, water should be poured into the worm ; which will force its way, by melting the concreted salt : and this must be repeated till the passage appear free, by the running of the water into the receiver without any sign of obstruction.

The whole worm must be, likewise, filled with water, by the same means, as soon as the operation is finished : the end of the small bending pipe, at the extremity of the worm, being first stoppt with a cork : and this water may be left in the worm, till the use of the pot is again wanted ; when it must be taken out, and put into the tritorium along with the other spirit, which it will nearly equal in strength, by having dissolved the salt concreted in the worm, according to the intention of its being put there. This should be carefully remembered : for, on the clearing the worm, by this means, of the salt, which is necessarily collected there, each distillation, depends the practicability of its use.

After the first, and every other distillation, the oil swimming on the spirit should be carefully separated from it ; which may be done, by passing this spirit through a large glass funnel, in the bottom of which, a piece of cotton is so placed, that the fluid passing through gradually, the oil may be kept from following the
spirit,

spirit, by removing the funnel after the spirit is gone through it.

The oil separated, in the second and third rectifications, should be put into a phial, and preserved; in order to make the fictitious salt of hartshorn.

After the last rectification, the spirit should be filtered, by means of the cullender, &c. described p. 32 : and, if it be kept a considerable time, the filtering may be repeated before it be sold, if the quantity be considerable.

This volatile spirit is, with regard to the medicinal intentions, equal in all respects, and in some superior, to the true spirit of hartshorn; for which at present it is generally sold: as is sometimes, likewise, the following kind.

Compendious preparation of a volatile spirit, resembling the above, and the true spirit of hartshorn.

Take volatile spirit of sal Ammoniacum, obtained by chalk, or salt of tartar, but without lime, one gallon; or two pounds of sal Ammoniacum, and the same quantity of dry pearl ashes, may be used, with a gallon of water, instead of the spirit; to this add, of the crude spirit of hartshorn, or bones, half

a gallon : distill them, as in the rectification of spirit of hartshorn, and draw off the spirit, while it comes over of a due strength : filter it, after it has been kept some days.

Note.

This will in all respects resemble perfect spirit of hartshorn, as prepared by the first process ; but if it be made of the crude spirit of hartshorn, like the true spirit, it will be apt to turn foul and foetid. That made with the spirit of bones will keep much longer ; but not so well as the produce of the former process.

However this substitution may resemble the true kind of spirit of hartshorn, or that drawn from bones, it will be inferior with regard to the medicinal qualities ; because, though it will appear equally replete with oil, yet it will not contain so great a quantity ; and what it may contain will be of a grosser, and less ethereal nature, as its tendency to grow foetid, and foul, evinces ; and, if kept any time, it will become nauseous, and be apt to rise on the stomach, like the genuine spirit of hartshorn.

This spirit is, however, much less exceptionable than another kind too commonly imposed on the public ; which is prepared by means of quicklime, after the following manner.

Sophistication

Sophistication of spirit of hartshorn, by means of quicklime.

To a gallon of crude spirit of hartshorn, or bones, add one pound of quicklime, either at the first, or any subsequent rectification; draw off the spirit, and treat it as the genuine.

Note.

This is, by much, the worst sophistication of spirit of hartshorn; and cannot be too much guarded against, by all, who are concerned in the sale, or use, of this medicine. When indeed it is drawn off with a due proportion of strength; and used only to smell to, its extraordinary pungency renders it very fit for the purpose: though this end may be equally well answered by volatile spirit of sal Ammoniacum, which is almost every where to be had prepared in the same manner: but when this kind is drawn off only of the apparent strength of the true spirit of hartshorn, and imposed, in its place, for internal use, it is a considerable fraud. For it is necessarily very defective, in the quantity of volatile salt; in which the principal efficacy of this medicine consists: the end of using the lime being to increase the pungency; and make the spirit, drawn off, much weaker, seem equally strong, with that impregnated with the

due proportion of volatile salt; and by this means, to increase the quantity. Which delusion occasions, therefore, only a part of the intended dose to be virtually taken.

If we paid an implicit deference to the authority of the college, there would be another reason against this sophistication: for they have condemned the use of lime with volatile salts, as rendering them noxiously acrimonious, and corrosive. But, if there were any truth in this principle, it must hold good, also, with respect to fixt alkaline salts; and yet we see, not only experience, but even the opinion of this great body itself, in the same work, assure us of the contrary. Nor does it indeed appear from facts, that there is any perfectly dissolvable body, which can injure by its acrimony, when sufficiently diluted.

This imposition of the spirit of hartshorn, or bones, actuated with quick-lime, instead of the genuine, is, however, supposed to be easily detectible, by the following means.

A method used for detecting the spirit of hartshorn sophisticated with quick-lime.

Add strong spirit of wine to the suspected spirit; and if it do not soon give the appearance of little sparkling bodies, swimming in the fluid, and afterwards subsiding to the bottom, it may be concluded to be sophisticated,

sophisticated, with quicklime, provided, by the pungency, it appear to be of due strength.

Note.

The principle, on which the above proof is grounded, is this. If spirit of wine be added to water, impregnate with volatile salts, in the proportion of good spirit of hartshorn, it will destroy, in a certain degree, the dissolving power of the water; and, consequently, a part of the salt, before dissolved, will shoot into small chrystals, which shew themselves, first in the form of little sparkling bodies, and afterwards in that of a shining powder at the bottom of the phials, or other vessel, in which the mixture is contained. But, if the spirit be sophisticated with quick-lime, this will not happen, from two reasons; first, because quicklime changes in such manner, the volatile salts, that they become so extremely soluble, the water can scarcely be saturated with them, in any proportion; or made to shoot them in chrystals, tho' they abound in any quantity whatever: secondly, because the spirit, so sophisticated, does not contain a sufficient quantity of salts, to occasion the chrySTALLIZATION of them from the weakning the soluble power of the water by the spirit of wine, even though their nature was not changed by the action of the quicklime. It may therefore be taken as a certain criterion, that the spirit is sophisticated

with quick-lime, if no such appearance follow, the admixture of the spirit : but this method of trial is nevertheless so far defective, that no inference can be drawn from it, with certainty, of the spirit's being really genuine, notwithstanding a very plentiful chrySTALLIZATION should ensue : though it has been hitherto looked on, as equally conclusive as to that point also. But a method has been contrived of preparing the spirit in such manner, that though the quantity of volatile salt be greatly deficient, and the appearance of due strength be procured by the help of quick-lime ; yet on this trial, with spirit of wine, the result will be the same, as in the spirit of hartshorn, where no quick-lime was used ; and the small chrySTALS will be produced, in such abundance, as to induce the opinion of its being extraordinarily good, if this experiment were a sufficient test. I have seen a quantity, not less than five hundred weight, treated in this manner, which passed the hands of persons, who thought themselves very skilful in matters of this kind : and I make no doubt this additional fraud would be more frequently practised, if known ; especially, as it increases the weight of the spirit at a very small expence. I shall therefore omit the teaching the method of effecting it ; and instead of that, give a sure way of discovering where it is practised, and of determining, moreover, in all cases, whether the spirit, when it appears of due strength, be prepared with lime, or not.

A more certain method of discovering, when spirit of hartshorn, or other volatile spirit, is sophisticated with quick-lime.

Mix strong spirit of wine with the volatile spirit suspected; and, if a chrystalline powder be produced, let it subside till the fluid can be poured off; and having put it into a spoon, hold it near the fire, or over the flame of a candle: if the powder exhale and disappear, it may be concluded, that the spirit is not prepared with lime, but contains a due proportion of volatile salt; but if it remain after it has undergone, even, a gentle degree of heat, it may be taken for granted, that not only the use of quick-lime, but other elusive methods have been practised.

Note.

I shall not explain the principles, on which this trial is founded, because they will be obvious to persons, who are any way versed in these matters, and a farther elucidation would lead others into the knowledge of the art it is intended to explode. But whoever purchases any considerable quantity of spirit of hartshorn,

would do well to prove it in this manner ; and may be assured, if it appear of due strength by its pungency to the nose, and stand this test, that it is not sophisticated with lime ; but properly replete with volatile salts.

Salt of hartshorn.

Let the salt be taken out of the receivers, after the distillation, or out of the retorts, after the rectification, before it be melted by the spirit, which will rise afterwards ; and sublimed, first with an equal weight of chalk ; and afterwards with a little rectified spirit of wine.

Note.

This is the process given by the college for the preparation of this medicine. The same may be done with respect to the volatile salt, obtained from bones, which will keep its white colour longer, and be much less subject to grow foetid, than that extracted from horn.

The quantity of chalk, here directed, is much greater than is requisite to absorb the oil, and prevent its rising with the salt ; for which reason only it is added : half the quantity, or less, will answer the end equally well.

The spirit of wine, which is designed to combine with, and wash down, the oil from
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the salt, does not, on experiment, answer the purpose, in a proportion equivalent to the inconvenience its elastic vapour, joined to that of the volatile salt, produces, during the whole operation, by forcing the lute : and it will be found, on trying both methods, that the sublimation will succeed, on the whole, better without it.

The sublimation of the salt of hartshorn is best performed in a retort, with a small receiver ; the neck of the retort being short and wide.

After the salt of hartshorn, or even that of bones, have been purified, in the best manner they can, by repeated sublimation, it will soon grow brown and fœtid, by keeping ; which is a great inconvenience to those who sell it, and have not a quick demand. The following fictitious kind has been, therefore, substituted for it ; being not only free from this incommodious quality of changing colour ; but, also, prepared with much less trouble and expence.

Fictitious salt of hartshorn, the same with the genuine in all other qualities ; and not subject to change colour, or grow fœtid.

Take six pounds of the volatile salt of sal Ammoniacum ; add to it half a pound of chalk, mixt with two ounces of the oil taken off the spirit of bones, in the rectification,

cation, as directed p. 97 ; sublime them together ; and separate the white part after the sublimation, from that which appears brown ; the latter being reserved for another sublimation, with a fresh quantity.

Note.

In making the volatile salt of the sal Ammoniacum, a part of it will necessarily arise foul, as we shall see below : such foul part will very well serve for this purpose.

If it be more convenient, instead of taking the volatile salt already made, to conjoin the making it, and the converting it into the salt of hartshorn, into one operation, the crude sal Ammoniacum, and proper quantity of chalk, may be used according to the process below given : and, in this case, it is best to mix the oil with chalk into a stiff paste ; and, having formed the mixture into balls, to put them into the retort after the other ingredients, that they may lie out of the reach of the stronger heat, which would occasion the oil to rise before the greatest part of the salt.

The salt, so prepared, is indistinguishable from the genuine salt of hartshorn, by any other means, than keeping it till the continuance of its white colour shall shew the difference : and, notwithstanding, I have given it the name of fictitious, it is in reality the same, with the salt obtained

tained by the regular process; except that the oil is of a purer, and more ethereal nature, than what is found in the other: on which account, this is certainly preferable, for other reasons, as well as its maintaining its whiteness, and not becoming foetid. Since, if we allow all volatile alkaline salts, to be the same, this must appear a better medicine, from the qualities of the oil it contains; and recommends itself still further by being of a much more cheap and easy preparation than the genuine.

Calcined hartshorn.

Let pieces of hartshorn, or the coal which comes out of the pot after the distillation of the spirit of hartshorn, be burnt in an open fire, till they become perfectly white: and, then, let them be levigated as other earthy, or testaceous bodies.

Note.

The college of London have directed this to be done in a potters furnace: and for those, who have not occasion to calcine such quantities, as may answer the expence of a proper furnace in their own elaboratory, the sending the materials to the potters, tobacco-pipe-makers, or other such persons, who have very strong fires for other purposes, will be the cheapest and easiest method.

Fictitious

Fictitious calcined hartshorn.

Let the coal of the bones, which remains, in the pot, after the extraction of the volatile spirit from them, be treated in the same manner as that of hartshorn.

Note.

This substitution is very frequently practised; and, if the bones be perfectly calcined, the earth will be indistinguishable from that of the hartshorn: being in fact absolutely the same substance. This, therefore, is a fraud productive of very little mischief; and may be permitted where any such are allowed.

It is, however, much more difficult, from their texture, to give the bones a perfect calcination than the horn: and it is, therefore, proper to break the coal of them, which is used for this purpose, into very small bits; which much facilitates the operation.

Volatile salt of sal Ammoniacum.

Take of the purest chalk, two pounds, sal Ammoniacum one pound, sublime them in a retort, with a strong fire.

Note.

Note.

This is the process of the London-college, and the common practice : but the quantity of chalk is much too great ; filling the retort unnecessarily, and adding, in some degree, to the foulness of the salt ; if the chalk, as happens very frequently, contain any impurities. The following is therefore a much better proportion of the ingredients : and the directions below given for the conduct of the operation, if observed, will produce a whiter salt, and with much less expence and trouble, than the methods commonly practised.

*Improved process, for the making the volatile
salt of sal Ammoniacum.*

Take the whitest sal Ammoniacum, dry it well while in large pieces, and pick out from it, and scrape off every part, which appears the least discoloured. Then take the cleanest chalk ; and dry it thoroughly, by heating it as hot as boiling water, but not hotter : powder it well, and dry it again : mix the sal Ammoniacum and the chalk, while both are in this dry state, in the proportion of five parts of chalk, to four of the

the sal Ammoniacum: put them into a retort, with a thick short neck, and the orifice cut very wide: fit to it a small receiver, with a long neck; and lute them well together. Then put them into a sand-pot; and sublimate the salt, very gradually; never suffering the lower part of the receiver to grow very hot. Let the fire, however, be raised to a strong heat at the latter part of the operation. When the retort and receiver are grown cold, break the receiver, and separate so much of the salt as appears white and pure, from the discoloured; and breaking it into lumps, preserve it carefully from exhaling, which will dull the transparent appearance. The less slightly, and foul, parts, may be used for the making the spiritus volatilis oleosus; or fictitious salt of hartshorn; or purified by resublimation, if that be more convenient.

Note.

By this method of diminishing the quantity of chalk, using only such sal Ammoniacum as is clean, and employing a small receiver, the necessity of a second sublimation is taken away:

away : for the purity of the fal Ammoniacum will occasion a considerable quantity of the volatile salt to be pure also : and render the retorts capable of subliming a greater quantity of the salt, by diminishing the quantity of chalk ; and the using at the same time a small receiver, will cause the cake of the sublimed salts to be of a due thickness ; which it otherwise cannot be made, without putting the produce of two or three of these operations together, and subliming afresh.

The scrapings, or foul parts, picked out of the fal Ammoniacum, need not, in the least, enhance the expence : for they may be used, for making the volatile spirits, or any other such purpose : neither will the foul parts of the sublimed volatile salt be in the least a loss, for they may be very profitably employed also, for the purposes abovementioned.

Great care should be taken, if the powdered chalk and fal Ammoniacum be kept after they are reduced to that state, either together, or separately, not to suffer the air to have any access to them : for they will immediately attract moisture, which is very detrimental to this operation ; as a very small quantity is apt to melt down the salt from the sides of the receiver into the bottom, and diminish the thickness of the sublimed cake, on which the produce of the saleable salt depends.

Much caution should be likewise used, in the management of the fire : for, if it be precipitated, not only a great risque is run of bursting
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ing the retort, or receiver; but, the salt, being in too hot a state, to form on the sides, will flow down to the bottom of the receiver, and produce the disadvantage before mentioned.

A cake of crude sal Ammoniacum will sometimes be found on the top of the chalk, after the sublimation; as likewise in the neck of the retort. This may be also used for making the volatile spirit, and the sal Ammoniacum, as the being mixt with the chalk will not in the least injure it for that purpose.

Volatile spirit of sal Ammoniacum with fixt alkaline salt.

Take of any fixt alkaline salt, one pound and half, sal Ammoniacum, one pound, water, four pints: with a gentle fire, distill off two pints.

Note.

This is the process of the London-College; in which the quantities seem very ill adjusted: for one pound of dry pure, fixt, alkaline salt is more than sufficient, to dispossess the volatile salt of the sal Ammoniacum of its acid spirit. The quantity of fluid drawn off is likewise very small, in proportion to the quantity of salt: for volatile spirit is extremely strong, when one fourth part of it is salt. This salt
may

may be prepared genuinely, and at a moderate expence, in the following manner.

Cheaper method of preparing the volatile spirit of sal Ammoniacum with fixt alkaline salt.

Take of sal Ammoniacum, and pearl ashes, equal parts; add to them about five times their weight of water; put them into the tin alembic described p. 40; and fix two receivers to the two arms; place it in the sand-bath; and distill off the spirit, while it continues to come off strong: when it appears weaker, change the receivers, and draw off the remainder so long as the fluid partakes of any smell of the volatile salts. Put by the strong for use; keeping the weak, to be added to the water in the next operation, of the same kind; or use it along with other volatile spirit, or salt, in the making the spiritus volatilis aromaticus; or for any such purpose.

Note.

The scrapings of the sal Ammoniacum, designed for the volatile salt, may be employed for this purpose: or the foul part of the vola-

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tile

the salt itself, dissolved, may be added to this spirit, when there is any convenience in so doing ; but the solution must be first filtered, if it appear in the least turbid.

The use of pearl ashes, instead of salt of tartar, which is directed by the Edinburg-college, or indeed of any other fixt alkaline salt, at present in use, is an obvious saving ; and comes within the latitude given by the college of London.

This spirit, however, is almost wholly excluded practice, by the use of that, made with quick-lime, notwithstanding the college of London have endeavoured, to prohibit the use of volatile spirit made with lime, on account of its supposed acrimony ; as was before mentioned. But the much greater pungency of the kind with lime, which renders it much fitter for the purpose of smelling to, on which account a great part of the demand is made, together with the inconvenience of keeping another kind for other uses, occasions it to be almost universally sold, instead of that with alkaline salt, by the wholesale preparers and dealers in medicine, to the apothecaries and retailers : and it is, therefore, proper to inquire into the best method of preparing it : especially as one particular medicine, the college themselves have given a place to in their last pharmacopæia, cannot be prepared without it ; I mean volatile tincture of the bark, which, in the spirit made with fixt alkaline salt, becomes only a mucilage.

Volatile

Volatile spirit of sal Ammoniacum made with quicklime.

Take of sal Ammoniacum, in fine powder, one pound, of quicklime, which has laid in the air till it be broken to powder, two pounds; mix them well, and put them presently into a retort, with two pounds of water: shake them, to mix the powder and water; and place the retort in a sand-heat; distill off about twelve ounces: but, the receiver being changed, about four ounces of weaker may be also drawn off.

Note.

This is the former process, used for the preparations of this spirit; but it is faulty in several respects.

The exposing the lime to the air, is so far from necessary, as to be very injurious to the qualities, by which it operates in this process: the quantity, also, of the lime, is much greater than needful; both filling the retorts with needless matter, so as to render the produce of the operation less, by even two thirds, than it may be by a better proportion of the quantities; to the great increase of the expence and trouble; and causing them, likewise, frequently to break

during the operation ; to the loss of half, or more, of the spirit.

The powdering the sal Ammoniacum, or making any previous mixture of it with the lime, before they are put into the retort, is likewise wholly needless ; for the salt will of course melt in the fluid as the warmth increases.

The quantity of water is likewise much too small : for at least twice the weight of the salt may be drawn off ; according to the proportion of the college in the spirit with salt of tartar ; and, as it is impracticable to draw off the whole fluid, (because the retort will crack, when the lime attains a certain degree of dryness,) that quantity of spirit cannot be obtained with this scanty proportion of water.

The following method, therefore, is much better ; amending these several errors ; and accommodating the materials to each other in due proportion.

Improved method of making the volatile spirit of sal Ammoniacum with quicklime.

Take of sal Ammoniacum four pounds, quicklime five pounds, water three gallons. Quench the lime in part of the water, and then put it into the pewter alembic for making this spirit, described p. 40 : add
to

to it the sal Ammoniacum, and water; and place the retort in the sand-bath: where distill off ten or twelve pounds, and then change the receiver; suffering, afterwards, the spirit to distill, while any pungency remains: this weaker spirit must be added, to the materials in some future operation, in the place of so much water.

Note.

By this diminution of the quantity of lime, a retort will, at one operation, distill at least three times as much spirit, as in the former process: and will frequently serve a second time for the same purposes; which can never happen when more lime is used.

It is usual to draw off four or five times the weight of the sal Ammoniacum; and the spirit will, even then, appear extremely strong: but, whoever would have this spirit correspondent to that of the college, made with fixt alkaline salt, must only draw it off in the proportion of three times the weight.

The use of quicklime, in making the volatile spirit of sal Ammoniacum, may be detected by the same trial of it, by means of spirit of wine, as has been given for the spirit of hartshorn: but as the common trial is subject likewise to the same elusion, as was before mentioned, the further means, before given,

of ascertaining the nature of the chrystals, produced on the addition of the spirit of wine, ought also to be used.

*Spiritus salis Ammoniaci dulcis ; or dulcified
spirit of sal Ammoniacum.*

Take of any fixt alkaline salt half a pound, sal Ammoniacum four ounces, proof spirit three pints: distill with a gentle heat, till a pint and a half be come over.

Note.

The proportion of the fixt alkaline salt to the sal Ammoniacum is here, as before in the old process for the volatile spirit, double what it needs to be: the quantity of proof spirit is likewise improper; for either, out of the three pints employed, half the quantity of real spirit must be left behind; or the spirit, which comes over, will contain much too little water, to keep dissolved the quantity of volatile salt produced: for, in order to have three ounces dissolved in a pint and half of spirit of wine, the spirit ought not to be stronger than proof spirit. But, as in fact, this process, so far as regards the addition of the spirit of wine, produces nothing more than a bare mixture of the solution of the volatile alkaline salt, and the spirit, (except the rectification of the latter) it may properly be rejected;
2 and

and the following simpler manner substituted, in its place, for obtaining the same composition.

Extemporaneous dulcified spirit of sal Ammoniacum.

Take of spirit of sal Ammoniacum, made with fixt alkaline salt, one pound : add to it rectified spirit of wine half a pound ; and shake them well together.

Note.

This will be, in all respects, the same with the other ; and may be made, occasionally, without the trouble of a distinct process : but, if the spirit be wanted, free from the appearance of salt, which will be found in this mixture, as well as in the spirit produced by the process of the college of London above given, water must be gradually added, till the salt be dissolved ; taking care, not to put in more than may be sufficient to that end.

Spiritus volatilis aromaticus, or sal volatile oleosum.

Take of the essence of lemons, and essential oil of nutmegs, each two drams, of the essential oil of cloves, half a dram, dulcified

spirit of sal Ammoniacum, two pints ; distill them, with a slow fire.

Note.

This is a very good and elegant composition: but the use of volatile spirit, with the proper proportion of spirit of wine, will equally well answer the end ; and spare the process for the making the dulcified spirit.

In this process, which is that of the college of London, it is intended, that a part of the dissolved salt should remain in the spirit ; in order to shew, that the spirit contains the proper quantity of salt ; and that, it is not prepared with quicklime ; but this is really no certain test of either : for there may be a false appearance of volatile salt, given by the means above hinted at, as well in this case as in those of the spirit of hartshorn, and volatile spirit of sal Ammoniacum ; which should, therefore, be explored, by the method above given, where there is any ground for suspicion of such a fraud ; as I have more than once seen this sophistication actually practised.

The spiritus volatilis aromaticus may, however, be prepared by a cheaper method than this process ; preserving both the same sensible and medicinal qualities.

A cheaper method of making the spiritus volatilis aromaticus, resembling that of the college of London, and equally good with respect to the intention.

Take of the volatile salt of sal Ammoniacum, made with chalk, two pounds, or the volatile spirit, made with fixt alkaline salt, of the full strength, six pounds; (if the salt, and not the spirit, be used, three pints of water must be added;) put the spirit, or dissolved salt, into a retort, together with eight pounds of proof spirit, half a pound of pimento or Jamaica pepper, two ounces of cassia lignea, and one ounce of essence of lemons: place the retort in the back part of the sand-bath; and distill off the spirit and salt till there be a cloudiness in the drops; then change the receiver, and draw off the remaining fluid while it appears to have any smell or flavour: this weaker spirit must be added to the materials with the next quantity made.

Note.

Note.

The aromatic spirit, thus prepared, will be equally good with that of the college; and may be made with much less trouble, and expence; if the foul part of the volatile sal Ammoniacum be employed for it.

But it is very frequent, to substitute in the place of these kinds, what is prepared by means of lime: and the greater pungency which the lime gives to the volatile salt in this sort, often imposes even on apothecaries, not greatly versed in the preparation of chemical medicines; and makes them believe it to be good. Where there is no undissolved salt in it, the distinguishing this kind, from that properly prepared, requires a new method of proof; for the mixing spirit of wine, which avails with regard to the other volatile spirits, is here evidently of no use. The following trial should, therefore, be made in this case, where the sophistication by lime is suspected, and the spirit is found very pungent to the nose.

Method of distinguishing when the spiritus volatilis aromaticus is made with lime, in the cases where there is no undissolved salt with it, and the spirit is yet found extremely pungent.

Take a small quantity of the volatile sal Ammoniacum, powdered, and put it gradually

dually into a phial, containing the spiritus volatilis aromaticus, which is to be proved: shake them well together; and if the spirit, notwithstanding its great pungency, sensibly dissolve the salt, it may be taken for granted, that it was made with lime; but if the salt remain intirely undissolved, or be dissolved but in a small degree, the contrary may be, with certainty, concluded.

SECTION II.

Of the preparation of those medicines, where vegetable substances make the whole, or principal part of the subject.

Salt of wormwood.

Take any quantity of wormwood, either fresh gathered, or dried gently; put it into an iron pot; and, with a gentle fire, reduce it to white ashes; which are afterwards to be boiled in a sufficient quantity of spring water, so as to make a lye: filter the lye, and

and exhale it, over a gentle fire, till a brown salt be left behind; which, by repeated solutions, filtrations, and evaporations, may be rendered white and pure.

Note.

The incineration, or burning, may be better performed, upon a clean hearth, in some place where the wind cannot blow away the ashes: and the repeated means of purification are needless, not only because they would fail to render the salt more pure than the first filtration alone, (provided it be performed through paper); but, because, if they did produce a purity, and whiteness, in the salt, they would render it unmarketable; as being wholly undistinguishable from salt of tartar.

This salt does not differ from the fixt alkaline salt, obtained from any other vegetable, by the same means; nor from salt of tartar; except that in the preparation of the last, a greater calcination being made, the burnt oil is destroyed, which gives to the salt of wormwood its brown colour.

It is very usual, therefore, to substitute the salt of other vegetables, for that of wormwood; there being no medicinal difference betwixt them, as we have before observed; as both the fixed salts and burnt oils of all vegetables are, when pure, alike in their qualities: but a fictitious salt may be made from pure fixt
alkaline

alkaline salt, exactly the same with the salt really obtained from wormwood, by the above process, if the following means be used.

Fictitious salt of wormwood, not differing, in any respect, from the genuine, but with regard to its production.

Take a little wormwood, and reduce it to the state of an imperfect charcoal, by burning it in a crucible, covered from the air; it must not nevertheless be burnt till the flaming quality be destroyed, but taken from the fire as soon as it is perfectly black. Put some of this coal, together with a pound of pearl ashes, into four pints of water, and boil them together: let them stand till they are cool, and then filter through paper, and evaporate to a dry salt; to which the burnt oil of the coal will have imparted a proper degree of brownness; that, if too great, must be adjusted by the addition of more pearl ashes purified by the filter.

Note.

This contains unquestionably the same elements, as the true salt of wormwood: since the oil, in which alone, there can be possibly supposed

supposed any difference, is here the same as in that.

This substitution may, therefore, be well allowed, in any view: and, with respect to the medicinal effects, the substitution of salt of tartar, or any other fixt alkaline salt, for the salt of wormwood, cannot be condemned on any maintainable principles, as any way injurious, or insufficient to the intention of cure; according to what we have before shewn.

Salt of tartar.

Let crude tartar of either kind, folded up in wet brown paper, or contained in a proper vessel, be put into the fire, and continued there, till all the oil be burnt out: the salt is then to be procured from it, by solution in boiling water; with a subsequent evaporation, after having been filtered thro' paper.

If the salt be required of a more saponaceous and pungent nature, let it be fused, in a crucible, for some hours, with a very hot fire, till it acquire a greenish, or blue colour.

Note.

Salt of tartar was also formerly made by de-
flagrating nitre and tartar: which may be done,
by

by powdering them together, in the proportion of two parts of tartar to one of nitre ; and then putting the powder, gradually, by a spoonful at a time, into a crucible, heated red hot ; which must be kept in the fire during the operation, and for some time after : The salt, being thus duly calcined, must be dissolved, and purified, as in the other processes, by filtering. But all these methods are greatly disused at present ; the wholesale dealers having learnt the secret of preparing a fixt alkaline salt, by the following much more profitable method, which is now for the most part used in the place of salt of tartar.

Fictitious salt of tartar.

Take of the best pearl ashes, any quantity ; dissolve them in boiling water, in the proportion of a pound to a quart ; when they are dissolved, let the solution stand till it be cold ; and then filter it through paper : being filtered, evaporate the fluid, till a dry salt remain ; which, being broken into a gross powder, must be put into a proper bottle of glass or stone, and kept carefully from the air.

The evaporation may be performed in a clean iron pot ; but not in an earthen pipkin ;

kin ; and the greatest care should be taken neither to let the solution, or salt, be put into copper, or brass vessels, on any account.

Note.

This, according to the principles before laid down, is, in all respects, the same as salt of tartar : and fixt alkaline salt being a medicine, which both used simply, and in the febrifuge draughts, is of the highest efficacy, and consumed in very great quantity : the substitution of this cheaper kind for the salt of tartar, which cannot be prepared without much greater cost and trouble, is rather a benefit to the public, than a detrimental fraud.

The neglect of the caution, above given, of avoiding the use of brass or copper utensils, in the preparation of salt of tartar, or this substitute, frequently occasions it to be very noxious : for by powdering it in brass mortars, from which it immediately collects all the rust, or indeed makes itself a corrosion if there be the least moisture, an emetic quality is acquired ; which affecting those, who take the salt in any form, induce them to believe the medicine itself disagrees with them, from its own nature.

The pearl ashes are frequently adulterated greatly with sea salt ; but this may be perceived by the taste if a small quantity be dissolved, for that purpose : and though, perhaps, they cannot be easily procured in a pure state, yet
if

if the solution be made in the proportion above directed for the water and salt, the greatest part of the sea salt will chrySTALLIZE, on the fluids being suffered to cool before it be filtered; and by this, a separation of the greatest part will be made; and the remaining small part will not deprave the fixt alkaline salt, for any medicinal purpose.

Oil of tartar per deliquium.

Take any quantity of salt of tartar, highly calcined: put it, in any stone, or glass, vessel, of a flat form, into a cellar, or any moist place: where let it stand, for several days, till the salt be dissolved, by the humidity of the air; then filter it through paper; or separate the fluid from the dregs by decantation.

Note.

As this is no way different from any other solution of the salt, of equal strength; or, as, if any change be produced by this method of solution, it can be only a depravity of the alkaline quality by the acid of the air, this process is needless: and, therefore, the following extemporaneous method of making this deliquium, is used instead of it.

*Extemporaneous method of making oil of tartar
per deliquium.*

Take of fictitious salt of tartar, above-mentioned, any quantity: dissolve it, by boiling, in half its weight of water; and filter the solution when cold.

If any salt precipitate to the bottom of the vessel, in the cooling of the solution, or be found in the filter, it may be saved; and put to the pearl ashes, when the fictitious salt of tartar is to be made from them; or used for any such other purpose.

Note.

This is a much more expeditious and commodious method, than the tedious manner of dissolving the salt, by the moisture of the air: which does it so imperfectly, that a great waste generally accrues.

Soluble tartar.

Take, of any fixt alkaline salt, one pound, of water, one gallon: to the salt, dissolved in the water boiling, throw in cream of tartar, gradually, till the effervescence, that before
arose

arose on each addition, cease to appear ; which will be, when, or before, three times the weight of alkaline salt has been thrown into it : then filter the solution through paper ; and, after a proper evaporation, let it be set to shoot into chrystals ; or otherwise make a total exhalation of the water, that the salt may remain in a solid mass.

Note.

As there is no necessity of a boiling heat, for the combination of the cream, and salt, of tartar, into the soluble tartar ; and, as this medicine is never given in a dry form ; it has been a practice with some, to spare all parts of this process, but the powdering the ingredients ; and to substitute the following simple preparation, in the place of the other.

Extemporaneous soluble tartar.

Take of any fixt alkaline salt, three pounds, of cream of tartar, one pound : powder, and mix them thoroughly together.

Note.

This will, on dissolving in any fluid, previously to its being taken, become exactly the same,

as if it had passed through the other omitted parts of the above process ; and cannot, therefore, be deemed a substitution of a very criminal nature.

In the preparation of this, it is proper to observe, strictly, the same caution, as in the case of the salt of tartar, with regard to copper or brass vessels.

Sal polychrestum solubile ; or, selle de Seignette.

Take of the ashes of the kali of Alicant any quantity, extract the salt according to art : and calcine it in a crucible, with a strong heat, that it may be freed from sulphur ; and afterwards form it into chrystals.

Take, of the chrystals of the salt of the kali, twenty ounces ; dissolve it in four pints of water ; add to it four pounds of cream of tartar, or sufficient to neutralize it : filter the solution, and set it by ; that the salt may shoot into chrystals.

Note.

This is the process of the pharmacopœia of the faculty of Paris, for the making the selle de Seignette ; which has lately been introduced into practice here ; prepared by the apothecary's company ; and prescribed by some eminent persons ;

sons; under the newfangled names of *selle de Seignette*, or *sal Rupiliense*: though it is obvious, on the perusal of the process, even to those who are but the least acquainted with matters of this kind, that it is no way different from the *tartarum solubile*, long known here; and given in several successive editions of the *pharmacopœia* of the college, and most other modern books, which treat of the preparations of medicines.

Nor does, indeed, the process itself, for the *selle de Seignette*, differ in any circumstance, even of form, from those given for the soluble tartar; except, in directing a previous preparation of the fixt alkaline salt, to be made from the *kali of Alicant*; which salt, when calcined, as there directed, to free it from the burnt oil, will be no way different, (according to the principles we have before laid down,) from any other fixt alkaline salt calcined to perfect purity: and were, indeed, the salt of the *kali of Alicant*, superior, in any qualities, to other fixt alkaline salts, so as to give some foundation, for distinguishing the soluble tartar, prepared from it, by a peculiar name, could the prescribers of it here expect, or the preparers pretend, that it is fetched from Spain for this purpose: but that salt of tartar, or some other fixt alkaline salt is used instead of it. They may, indeed, say, that we have a Spanish salt here under the name of *Barillas*, that is the same with the salt of the *kali*; and they may equally well say the same of the Russian pearl ashes, or any

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other

other fixt alkaline salt prepared in the same way.

There is, indeed, a particularity practised in the preparation of the salt of kali, here directed, (which is the forming it into chrystals) that is never done in the case of other fixt alkaline salts: but this can no way make any difference in the composition of this medicine, being only an accidental form, or configuration, of masses of the salt, and no variation of its absolute nature: and, indeed, the reason why the chrySTALLIZATION of fixt alkaline salts is wholly neglected, is owing to its being not in the least necessary, or conducive to any one end, or purpose, to which these salts are applied in medicine.

Wherever, therefore, *selle de Seignette* is prescribed or demanded, the soluble tartar, prepared according to the processes above given for it, may be administered or sold; as it is in fact the same: only, to support the due appearance, it is necessary, that it should be shot into chrySTALS; and not evaporated, as usually, into a dry mass: chrySTALS being the form which the Parisian dispensatory directs.

Of cremor tartaris, or cream of tartar.

Let the crude tartar be powdered, and dissolved, in sixteen or eighteen times its weight of water in the boiler, which is described p. 34 as part of the apparatus for
making

making this falt : let the heat be then checked, that the fluid may ceafe to boil ; and after it has flood at reft, in a heat near that of boiling ; but lefs than will produce any ebullition, till it become clear by the fubfiding of the feces, turn the cock of the pipes, which makes the communication betwixt this boiler and the cylinders ; (described as a part of the apparatus) ; and, when the cylinder is filled with the folution, turn again the cock, and flop the communication ; let the fluid then remain in the cylinders, till the chryftals be formed at the bottom and fides ; and then return back the mothers into the boiler ; and add a fresh proportion of crude tartar ; repeating the fame operation till a confiderable quantity of chryftals are crufted on the cylinder : but, if the fluid, on returning it into the boiler, appear to abound in feces or foulnefs, pafs it through a large flannel bag ; and add, if neceffary, a fresh quantity of water, as well as crude tartar, to fupply what is confumed in the boiling : when a fufficient quantity of chryftals are formed in the cy-

linder, they must be taken out into baskets; and, the fluid being drained off, they must be dried for use: the cake of chrystals at the bottom of the cylinder, which will generally prove foul from the sediment, must, if found so, be returned into the boiler along with the crude tartar.

Note.

By this method, a great quantity of the salt may be purified, and chrystallized; which, by common methods, is impracticable; as it requires so very large a proportion of water, for the dissolving it; and, consequently, becomes much too voluminous to be managed in glass vessels, as other salts.

It has been said, that the common preparation of cream of tartar, which is in the hands of a very few persons, is not a purification and chrystallization only; but an adulteration, by means of white earth added to it in the solution. But I think the contrary of this is evident, from the qualities of the salt, as we generally find it: for, allowing that there were a redundant portion of a unneutralized acid, in the crude tartar, and that, such acid combining with this white earth, another species of salt might be formed, together with the chrystals of the tartar; yet this earth would become apparent on the admixture of fixt alkaline salt in
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the preparation of the tartar solubilis ; or on any other occasion : as it would be then necessarily precipitated ; and render the fluid white and turbid, while in an agitated state, settling afterwards in the form of a powder. Now, this appearance not being found to happen, we may certainly conclude, that there is no adulteration of this salt by means of any earth ; since the power of fixt alkaline salt, which precipitates the earth, from all neutral salts, of which it is the basis, is a sure test, in this, and all other cases, where it may come in question, whether such salts be formed of earth, or not.

Vitriolated tartar.

Take, of green vitriol, eight ounces, of water, four ounces ; throw salt of tartar, or any other fixt alkaline salt, to the vitriol, dissolved in the water boiling, till all ebullition cease ; which will be, when four ounces, or something more, of the salt has been used : then filter through paper ; and, after due evaporation, let the fluid stand, that the salts may shoot.

Note.

Vitriolated tartar is, with much more convenience, made from oil of vitriol, than from the crude vitriol : since, as the only reason, for
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the preference of the vitriol to the oil, must be the saving made in the price, even that will scarcely hold good, when all things are considered: and, as the large quantity of oker, precipitated from the vitriol, retains, unavoidably, a considerable quantity of the solution, in the filter; and, consequently, occasions a proportionable waste of the vitriolated tartar. But, if there really was a saving in the expence of the materials, it would not countervail the trouble and depravity of the salt, which are apt to attend on this method of making it: for, if the operation be not conducted with the greatest care, and even some good luck, a disagreeable ochrous flavour, and brown colour, will be found in the salt produced: from which, indeed, it is scarcely possible to keep it free, when prepared from crude vitriol.

It is, therefore, much better to use the oil of vitriol instead of the salt; and, in that case, the process may be the same in all other respects.

It is almost an universal practice, to substitute, in the place of the vitriolate tartar, thus prepared regularly, the caput mortuum taken out of the retorts after the distillation of spirit of nitre, prepared from oil of vitriol; and as this is done, without any other preparation than powdering, the salt, generally contains a considerable quantity of oil of vitriol, which the fire has not been powerful enough to raise in the distillation as commonly managed; and is, therefore, though in other respects the same with the vitriolated tartar prepared in the manner

manner above directed, very unfit to be used, in the cases, where this medicine is most serviceable; as a dose, sufficient to act in the cathartic intention, will sometimes contain much more oil of vitriol, than should, at any time, be given; whereas, moreover, on this occasion, any quantity is improper. This substitution, however, with due preparation, may be very well allowed; for, on being duly neutralized, and formed into chrystals, this salt differs, in no respects, from that prepared by the most regular method, and it may be, therefore, thus managed.

Manner of preparing vitriolated tartar from the caput mortuum, remaining after the distillation of aqua fortis by Glauber's method.

Take, of the caput mortuum, any quantity; dissolve it in water boiling; and add to it, pearl ashes, in the proportion of one ounce to every pound; or two ounces, if the caput mortuum appear very acid to the taste: filter the solution; and chrySTALLIZE the salt.

Note.

By this method, this most valuable medicine, for which hereafter there will probably be a very considerable demand, may be made
extremely

extremely cheap, and perfectly good. At present, the depraved state, in which it is sold, prevents its being prescribed under this name: and, indeed, this absurd substitution has so far prevailed; that the acid taste, and the form of a powder, are looked upon as essential qualities, in the shops. But, whoever would have the vitriolated tartar, in a perfect state, must ask for it under the name of sal polychrest; which, though directed, in dispensatories, to be prepared by different means, is yet the same substance, in every respect, as was before shewn. It is, likewise, always adviseable to insist on having this salt in the form of chrystals, and not powdered; to prevent the imposition abovementioned; or others which may be attempted.

The chrystals of this salt resemble greatly to the sprigs of chrystal stone, but of a less length, by which appearance, they may be easily known from the sal catharticum, or any other.

Distilled vinegar.

Let vinegar be distilled, with a gentle heat, as long as it will rise without any empyreumatic smell.

Note.

This is the direction of the college, with respect to this preparation; and, I think, it
may

may be esteemed unfortunately defective ; as the not dictating in what kind of vessels the distillation should be made, has given countenance to a practice, which both before, and since, has greatly prevailed, of performing this operation in the worm still. Now the worm being in general made of bad pewter ; in the composition of which, lead has the greatest part, the vinegar, by passing through so long a tube of this metal, of which it is a strong menstruum, cannot fail to dissolve a considerable quantity. The college of Edinburg have seemed properly apprised of this inconvenience, for they order the alembics, for this use, to have glass heads. What the ill effects of sugar of lead, internally taken, may be, I shall not particularize here, as they are the same with those, so frequently seen in persons, who work with lead : but that this bad practice may be detected, and the use of vinegar, thus depraved, avoided by those who are duly cautious, I offer the following infallible method of discovering, where the vinegar is impregnated with lead in any material quantity.

Method of discovering, where vinegar is depraved with lead, by distillation with a worm.

Take some of the vinegar questioned, and add to it a small quantity of the solution

tion of any pure fixt alkaline salt: if a cloudiness, or milky turbidness, ensue, and a white powder be afterwards precipitated, it may be concluded, the vinegar contains dissolved lead; but, if the fluids retain the same clearness and transparency, after their commixture, which they had before, the contrary may be, with certainty, inferred.

Note.

This will be a certain test of the purity of the vinegar, with regard to lead; as the fixt alkaline salt has the certain power of precipitating even the least quantity; which must become visible, unless immaterially small.

In order, however, to take away this temptation, to the use of the worm, which the flowiness of this operation, when performed in glass vessels, gives, I shall recommend the following method.

Compendious method of distilling vinegar.

Let the operation be performed in the alembic described p. 43; which should be placed in the warmest part of the sand-bath; and, in the latter part of the operation, the sand should be raised round the alembic, that

that the upper part of it may be as much heated as possible.

Note.

By this method, not only a much greater quantity may be distilled at one operation, from the increased magnitude of the alembic, than the use of retorts admits of; but, by raising the sand near to the height of the arm, the vapour of the heavier part of the vinegar, which is with difficulty brought over the helm, may be prevented from being condensed on the sides of the alembic, and remaining in the body of it after the operation.

Distillation of oil of turpentine.

Let the oil be distilled from the turpentine, in a proper alembic; water being added to it: the caput mortuum, left behind, will be white resin.

Note.

This is performed but by few persons; some great undertakers supplying the whole consumption.

The best alembic for this purpose, is that described p. 41. The pot may be made as large as the founders can conveniently cast it, and consequently very capacious; and a moderate

rate worm will be found sufficient for the condensation.

Tar has been substituted, in the place of turpentine, for the obtaining this spirit; which is the same in both; and, in this case, the colophony, or caput mortuum, left after the distillation of the spirit, will be pitch instead of resin: but, to keep this pitch in a vendible state, it is proper not to rob it of too much of the spirit, which would render it of too dry and brittle a nature, for most purposes. This substitution of tar, for turpentine, may be authorized in a medicinal view; as the spirit obtained from each is in all respects the same.

Rectified spirit of wine and alcohol.

Take any quantity of French brandy, and distill off one half with a very gentle heat: this rectified spirit being digested for two days, with one fourth of its quantity of salt of tartar dried and powdered, and distilled with a very gentle heat, becomes alcohol.

Note.

It is immaterial from what kind of cruder spirit the rectified spirit is made, provided there be no foul empyreumatic scent in it. The much higher price of French brandy than malt spirits, renders the latter preferable, on which

which account, the college of London have given no process, but leave this preparation to the distillers, who can manage it with less expence than those, who have occasion to rectify small quantities only. But for the sake of such as may not have an opportunity of procuring highly rectified spirits, or alcohol, on account of their distance from these large works, or who may want alcohol stronger than it is prepared there, I shall observe, that the digestion of the spirit and salt of tartar, as ordered in the above process, is wholly unnecessary, and the quantity of the salt far too large : and follow, therefore, a much better method.

More expedite method of preparing highly rectified spirit of alcohol.

Take malt spirit, rectified by one distillation, any quantity: add to it pearl ashes, heated red hot, and powdered grossly, with the greatest dispatch, to prevent their cooling, in the proportion of one ounce of the salt to a pound of the spirit ; shake the vessel for some time, and after it has stood half an hour, or longer, repeat the shaking again for several times : the salt will then be dissolved ; and, having attracted the water, will occasion its separation from the spirit, which

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will rise above it ; and must be parted from it by decantation. To the spirit thus separated, then add, to every pound, one ounce of the salt, heated and powdered as before ; and proceed again in the same manner as at first. After this second decantation of the spirit from the salt, distill it in a retort, with a very large receiver, in the most gentle part of the sand-bath.

If the spirit be not required very strong, the addition of the second quantity of the pearl ashes may be spared ; and where it is wanted exceedingly strong, a third may be employed.

Note.

The separation of the phlegm from the spirit, being made by the fixt alkaline salt, before the distillation, that operation is only required, in order to free the spirit from a very small quantity of it, which may remain dissolved in the unseparated phlegm of the spirit : but, as the presence of the salt does not in the least deprave the spirit for any medicinal purposes, the trouble of the distillation may be spared ; and the alcohol applied in this state to all such uses. But, with respect to some other uses, in which it is employed in some trades and manufactures, particularly

particularly in the making laquers and varnishes, the distillation is indispensibly necessary; as the alkaline quality of the salt would change the colour of the gum used in compositions of that kind; and other inconveniences might arise from the presence even of the smallest quantity of the salt.

Boerhaave invented and recommended a species of alembic for this purpose, in which, means of a very tall head, of a conical form, he pretended the spirit might be freed, more efficaciously, from the phlegm, in one rectification, than by several, in the other kinds of alembic employed for this end: because, as he supposed, the vapour of the phlegm and spirit ascending up this tall head, would come in contact with the sides of it, which being heated by them beyond the degree that spirit of wine can endure, without rising in vapour, and yet under that which is sufficient to raise water, the spirit would, therefore, be continued in the state of vapour, and pass into the pipe which is designed to carry it from the head to the refrigeratory; and the water be condensed in the head itself; and run back into the body of the alembic. But though this appears very specious in theory, it is of little avail in practice; for one point of heat alone being requisite in the head to effect this properly, it is impracticable to maintain it; and if there be less, the fumes of the spirit will not be raised to the top of the head, so as to pass into the pipe; or if more, the water will pass

with it; as always happens shortly after the proper degree of heat be obtained.

Ethereal spirit.

Take, of spirit of wine, four pints, of oil of vitriol one pound: mix, and distill them according to the directions below given for the spiritus vitrioli dulcis. Take the spirit which comes over; and add, to it, of oil of tartar per deliquium, or of the saturate solution of any fixt alkaline salt, four ounces, and mix them well together; and a substance, of the appearance of oil, will then rise on the surface of the fluid; which must be taken off as quickly as possible; for it will exhale almost instantly, if it be exposed to the air: add then further quantities of the solution of the fixt alkaline salt, one ounce at each time, and take off all the, oil that shall appear at each addition. It must be kept in phials, with glass stoppers, extremely well fitted to them; or it will escape by its extremely great volatility.

Note.

This is the ethereal spirit, which Frobenius, a German chemist, first introduced the knowledge

ledge of here. It was then accounted only a curiosity ; but since, it has a place given to it as a medicine, in the last edition of the dispensatory of the Edinburg-college.

Flowers of Benjamin.

Put powdered Benjamin into an earthen pot, placed in sand : with a gentle heat, the flowers will rise ; and may be caught in a taper cone, fitted to the pot.

The Benjamin may be, otherwise, put into a retort ; and the flowers will rise, and be collected in the neck..

If the flowers be tinged with yellow, they are to be mixed with tobacco-pipe-clay, and resublimed.

Note.

The college of London have given, in this process, an intimation of the method of subliming the flowers of Benjamin, by means of a paper cone ; which is far preferable to the use of a retort, or to any other method practised : but the directions are so general and indistinct, that most, who have tried to avail themselves of them, and have not been otherwise apprized of the proper method, have greatly miscarried in their attempts ; I will, therefore, subjoin some more particular directions, for the management of this process with the paper cone.

The pot is best made of the stone ware, such as is manufactured at Vauxhall ; and it should taper in such manner, at the top, that the paper cone may exactly fit it.

The paper should be that called bloom, or blotting paper ; the more spungy, in its texture, the better : the cone should be formed of two sheets laid together, and so adapted to the pot, as to come, only about two inches over the sides of it, when put on. By having the cone of paper thus double, the oil will be the more absorbed, and the flowers by that means freed from it.

It is best not to put the pot, which contains the Benjamin, immediately into the sand-pot ; but into another earthen pot, large enough to contain it with sand round it ; which larger earthen pot, being put into the sand-pot, may be sunk, or raised higher, at pleasure : by which means, the heat of the pot, containing the Benjamin, may be varied in a very quick manner ; and more easily adjusted to the occasion, than if it were placed in the sand-pot. The heat must be very gently raised ; and continued at that degree, which will raise the flowers in the slowest manner ; and it may be known by the warmth of the upper part of the cone, if it be sufficient to that effect.

If the paper of the cone seem greatly foul with the oil, it should be taken off, and a new one supplied.

By these means, with a very little experience, as to that nicety in the degree, which admits
of

of no description, the greatest part of the flowers, in any quantity of Benjamin, may be obtained white, without any second sublimation.

Purification, or refinement, of camphor.

Take, any quantity of crude camphor, and put it into the glasses described as proper for this use p. 30 : place the glasses upon the sand, in the pots made as directed p. 25, for the sublimation of calomel ; and give the furnace a gentle degree of heat : the camphor will be raised in fumes ; which will coalesce, and form a cake on the upper part of the glass ; and the operation must be continued, till the whole be sublimed from the lower part of the glass ; which may be known by the abatement of the heat in the upper : the glass must be broken, when cool ; and if there be any foul part, in the cake of camphor, it must be separated, in order to be resublimed with any fresh quantity : the other part will be then proper for use.

Note.

As the camphor must be purchased of the East-India company, in considerable quantities,

to make the being concerned in the refinement of it profitable, there are very few who undertake to meddle with it : but it is an article very well worth the notice of those, who have the knowledge, and opportunity, of managing it rightly.

The greatest nicety is in properly adjusting the heat ; which, if too great, endangers the bursting out of the fumes, as they are very elastic from the great volatility of the camphor ; and making thence an intolerable waste : or, otherwise, if the fire be too low, the fumes will settle on the sides of the glasses, in the form of flowers, without attaining the crystalline texture ; and, when these flowers are increased to a certain quantity, will fall down again into the bottom of the glass, and occasion a tedious, and almost perpetual circulation. The method, however, to judge of the right heat, is to learn to distinguish it by feeling the glasses ; and it is best to keep it up, at the highest point, which can be maintained, without forcing the vapour out through the neck of the glass : and in order to effect this more easily, it is proper to heat the furnace to the due degree, and continue it so for some time, before the camphor be placed upon the sand.

There is another manner, in which camphor may be refined, with very little trouble, by those who have occasion to rectify spirit of wine from proof spirit : it is as follows.

Purification,

*Purification, or refinement, of camphor, by
solution in spirit of wine.*

Take, any quantity of crude camphor ; and dissolve it in spirit of wine ; making the solution as strong as possible : let it stand at rest, till all the feculencies be subsided ; and then pour off the clear solution from the sediment : filtering the remaining foul part through paper : add very clean water, then, to the solution, by very small quantities, as long as any white turbidness appears to be produced on its further admixture : the camphor will then be precipitated to the bottom of the vessel ; but will be found to be in form of a powder ; to reduce which into a chrySTALLINE cake, proper for sale, the spirit of wine being decanted off from it, and some clean water added, put it into a Florence wine flask, and place it in a gentle sand heat, till the camphor be melted ; when the flask being taken off immediately, and broken when cold ; the camphor will be found to be
formed

formed into a transparent cake, such as is commonly fold.

N. B. The spirit of wine, being rectified, will serve again for the same purpose.

Note.

This is a very easy and profitable method to those, who have opportunities of rectifying the spirit of wine, thus lowered by the addition of the water, along with other quantities ; as giving, in that case, no additional trouble : and even, where the spirit of wine is purposely to be rectified, this is, perhaps, the easiest way, if the quantity of camphor to be refined be considerable : though the first process alone is at present practised.

SECTION III.

Of the preparation of medicines, where fossile substances, not metalline, make the whole, or principal part of the subject.

Calcined vitriol.

LET green vitriol be put into one of those earthen vessels, called pipkins, which must be only three parts filled with it ;

it ; place the pipkin over a common fire, in a heat juſt ſufficient to make it boil : when the ebullition is almoſt over, the ſpace the vitriol at firſt took up in the veſſel will be greatly contracted ; which muſt be again filled up with a freſh ſupply of vitriol ; and the boiling continued till this, alſo, become quiet ; and the veſſel muſt be thus recruited, till it become full of vitriol, after all ebullition ceaſe : the vitriol will be now a hard white maſs ; and muſt be freed from the veſſel by breaking it.

If vitriol, calcined to redneſs, or as it is called, colcothar, be wanted, the veſſel ſhould not be broken, but put, with the vitriol in it, either into the body of the ſame fire, where it was calcined to whitenefs, or into a wind furnace ; and there continued till the vitriol appear red. After which it ſhould be ſeparated from the veſſel which will adhere to it ; and, as ſoon as poſſible, put into a bottle, with a glaſs ſtopper, to prevent its deliquating in the air ; to which it is in this ſtate extremely diſpoſed.

Note.

Note.

It has been usual, in the processes given for this preparation, to neglect any directions with respect to the filling the vessel too full at first, by which means, the loss of great part of it has generally happened; and the omitting, also, to refill the vessel as the space of the first quantity contracts, occasions a loss in the number of vessels used to calcine any quantity; as they must always be broken: which, if this method be not practised, will be, as three to one, more than is necessary. It is usual to substitute the caput mortuum, after the distillation of oil of vitriol, in long necks; as, also, that left after the distillation of aqua fortis, where vitriol is used, instead of the vitriol calcined to redness; but where the calcined vitriol is wanted to be applied as a styptic to stop bleedings at the nose, or elsewhere, this substitution is improper; as the too great calcination of the vitriol, in the distillation in long-necks destroys the styptic quality; and in the caput mortuum of the aqua fortis, but a part of it is calcined vitriol; and the other part a substance, not correspondent in the least to the intention, and which, therefore, depraves the calcined vitriol.

Oil of vitriol.

Take any quantity of vitriol calcined to whiteness: powder, and put it into the
earthen

earthen pots made for this purpose (called long-necks) : let them be placed in their proper furnace, with a receiver luted to each ; and raise the fire gradually to the highest degree, in which it must be continued, so long as any white fumes appear to come into the receiver : the fluid obtained in the receiver must be afterwards put into a retort ; and placed in a sand-furnace : the spirit, which first arises, must be taken out of the receiver as soon as the drops, which fall from the retort, appear extremely acid : the remaining part must be brought over, by means of a strong fire ; and the two kinds kept separate for use ; the one being called spirit, and the other oil of vitriol.

Note.

This is the authorized process ; but the preparation of oil of vitriol being seldom made, except by those, who carry on very large concerns, and have no particular view to medicine, the preserving two distinct kinds is seldom regarded : and, where spirit of vitriol is demanded, the oil lowered by an equivalent of water, is substituted for it : and is, in fact, the same thing ; the acid, which rises first,
and

and that which comes afterwards, differing in nothing, but the being accompanied with a greater or less quantity of phlegm, impregnated with the sulphureous gas produced in the burning.

This method, of producing the oil of vitriol, has been greatly excluded from use, by the improvement made lately in the art of obtaining this substance from sulphur: by which means, the price has been reduced, in the wholesale dealings, from ten pence, or one shilling per pound, to four pence. The process was kept secret for some time; and is as yet in few hands: but, for the benefit of those, who may either chuse to enter into such a work, in order to supply the market, or who may have occasion for a considerable quantity for their own use, in any manufacture or business, I shall give here the most expedite manner hitherto invented of performing this process.

Manner of extracting the oil of vitriol from sulphur, by means of the apparatus described p. 44.

Take, of crude sulphur or brimstone, five parts, of crude nitre (or as it is called rough nitre), one part, powder and mix them well together: put this mixture, into the spoonstoppers, in three layers; separating each layer

layer by a thin wad of tow : set fire, then, to the sulphur and nitre, with which the stoppers are thus charged, and put them into the necks of the globes ; which, having first a gallon of water poured into them, must be placed in their proper frames, on the sand-bath ; but must not be suffered to go deeper into the sand, than the height of the water : it must be also understood, that the sand should be previously so heated, as to raise a copious steam in the globe ; but not greater than can be condensed, without heating the sides considerably. The stoppers being thus put into the globes, the materials contained in them will continue to burn ; and will fill them with white fumes ; which, meeting with the steam of the water, they will mix and be condensed together on the surface of the glass : as soon as the materials cease to burn, which may be known by the cessation of the white fumes, let the stopper be taken out ; and another charged, in the same manner with the materials, put in its stead : and let this be repeated, till each of the

globes contains three or four gallons of fluid: then let them cool ; and, when cold, take out the fluid by declining the neck by means of the frame.

Let the weak oil, thus obtained, be then put into retorts, and dephlegmated, by drawing off the aqueous fluid, till the remaining part be of due strength ; the degree of which may be regulated by the proportion that the water, put into the globes, bears to the quantity of the weak oil when taken out ; by observing which, and fixing on a proper standard for the strength, it may be known when the oil is dephlegmated to the due degree, by the quantity of water brought over into the receiver, which should be measured, when it is imagined that near the proper proportion is drawn off : but, as this cannot be performed, with respect to the contents of one retort, without the repeated trouble of taking off the receiver, it is proper to dephlegmate the contents of some particular retorts higher, and by mixing the several quantities dephlegmated in a number together, and measuring the re-
spective

spective quantities of phlegm in the receivers, also, the whole may be easily brought to the standard required, by means of the produce of those retorts, which have been higher dephlegmated; in order to supply the deficiency of such as may be too low.

Note.

This is a method, by which oil of vitriol may be obtained at a very low expence: especially, if the quantity manufactured together be very considerable: and other preparations, such as aqua fortis, sal mirabile, sublimate, &c. in which the undephlegmated spirit may be used, are likewise carried on, together with this.

The principle, on which the improvement in this method depends, is, the burning the sulphur with nitre, instead of being obliged to suffer an access of air: the draught of which, of course, carries off with it, the fumes of the sulphur; as was always found in the several manners of the process, for distilling this substance by means of glass bells, or other such vessels; by the best contrived of which, but a small quantity of the acid spirit could ever be collected. Whereas, by the use of nitre, the sulphur being burnt, in a close vessel, without any steam of air to carry off the acid vapour; which, on the contrary, in this method, meets

continually with the steam of water, that greatly assists its condensation, almost the whole quantity of this substance, contained in the sulphur, is obtained: and by such expedite means, as renders the expence small, where a large work is carried on.

The invention of this method is generally given to the persons, who a few years ago took out a patent for it: but it is very well known, that Cornelius Drebbel, a Hollander, amongst other improvements of arts, found out a method of obtaining five ounces of the acid spirit, from eight ounces of sulphur: and though the practice of this art was, on his death, discontinued, yet I can produce the model of an apparatus, for extracting the acid spirit from sulphur by means of nitre, which was made a considerable time before that patent was applied for.

Though I call this oil of vitriol, as almost the whole now sold, under that name, is the spirit of sulphur thus prepared; and the acid of vitriol does not differ from it, when both are pure, as was before shewn p. 80: yet this is not, in reality, the pure vitriolic acid; for, by this use of nitre, in its preparation, it contains an eight or ninth part of spirit of nitre; which is set loose from the nitre, in the deflagration. But though this may possibly deprave it, with respect to some nice experiments, and extraordinary purposes; yet it very well answers the purpose of pure oil of vitriol, with respect to its use in the arts and manufactures, in which it is employed; and may be, likewise, allowed as

a substitute, either for the oil of vitriol, or spirit of sulphur by the bill, for all medicinal purposes. And this may, therefore, be looked upon, as one of the most important inventions, that have been of late made public.

Spiritus vitrioli dulcis, or dulcified spirit of vitriol.

Take, of oil of vitriol, one pound, rectified spirit of wine, one pint: mix them, gradually, with the utmost care: and distill them, with a very slow fire, till a black froth begins to rise: then, immediately, let the receiver be taken away, lest the froth rise into the neck of the retort, and flow into it.

Note.

This is the process of the London college; in which, the proportion of oil of vitriol is much greater than has been generally used: and indeed than is necessary, as the far greatest part of it will be left behind in the retort. The college of Edinburg have ordered only six ounces of the oil of vitriol to four pounds of the spirit of wine: but as the oil of vitriol is a very cheap ingredient, one pound to four may be used; which, if something more than sufficient, cannot, therefore, occasion any material loss.

The intention of so large a quantity of oil of vitriol, was, to render this a previous preparation for the elixir vitrioli dulcis : but, as there can be only a certain proportion of the acid raised, by the spirit of wine, the adding more, in the undistilled mixture, cannot produce a greater proportion in the distilled spirit ; unless a much stronger heat than that of the sand-baths, in which this medicine is, (and ought to be,) prepared, were to be used.

In this process, the greatest care should be taken, in mixing the two ingredients : for which, the safest method is, to add the oil of vitriol to the spirit of wine, by small quantities ; and to let the mixture stand each time, without further addition, till it can be shaken without producing any sensible heat. When the whole is commixt, it should, likewise, be suffered to stand, some time, before it be distilled : but there is no occasion for digesting it several days ; as is directed by the Edinburg college.

The usual adulteration of this medicine, is, by lowering it with water ; which may be perceived by its losing the volatile pungency, and suffocating scent, that it gives to the air around it, when any vessel containing it is opened.

Spirit of nitre.

Take, of salt petre, and oil of vitriol, equal quantities, of water, the proportion
of

of one fourth or fifth to the other ingredients : mix the oil of vitriol, and water, by adding the former to the latter in small quantities ; giving time for the mixture to cool betwixt each addition ; to avoid the heat, which will be otherwise excited, to such a degree, as may break the vessel that contains the mixture, and produce other inconveniences. Put the salt petre into a retort, and afterwards the oil of vitriol and water : when the whole is mixt together, let them stand some hours, the mouth of the retort being stoppt with paper ; and then lute on a receiver, and distill them, with a heat gradually raised to the greatest degree, while any red fumes appear to rise.

Note.

This is the regular and common process for spirit of nitre ; but it is faulty in several respects.

The quantity of oil of vitriol is far too great, for that of the salt petre : half the weight of oil of vitriol being sufficient, to discharge its proper spirit from the nitre, as appears, as well from clear reasons drawn from the nature of the two bodies, as from experience : and, when this redundant quantity of the oil of vitriol is used, either near one half will be left behind in

the retort, if the fire be not very powerful, or the spirit, which comes over, will not be spirit of nitre; but a compound of almost equal parts of the spirits of nitre and vitriol. It is impracticable, indeed, to obtain a pure spirit of nitre, if this proportion be adhered to, which, tho' not very important with regard to all medicinal purposes, is yet so for some; as particularly in the solution of mercury, for the preparation of red precipitate; and, in the greatest degree, with respect to the arts of gilding, and others, where spirit of nitre is wanted. On the contrary, the proportion of the oil of vitriol to the nitre, in the dispensatory of the college of London, is much too little: being but as one to three; which is not sufficient to discharge the acid from the whole quantity of nitre; and, therefore, not only wastes so much of the nitre, as a half exceeds a third, but, also, diminishes the produce of the operation, in the same proportion, by filling the retort in part, with fruitless ingredients.

The putting the water, with the oil of vitriol, into the retort, is likewise an error, as it protracts the operation; and is of no use with relation to the dissolving the salt-petre, as is intimated in some processes given for this preparation; but only in rendering the fumes more condensable; which end, it full as well answers, when put into the receiver before it be joined to the retort.

The use of purified nitre, or salt-petre, is, also, an unnecessary expence: for the crude
nitre

nitre (or rough petre, as it is called) will equally well answer the end : and is to be procured at a considerable less price. But there being two kinds of this brought from the East-Indies, the one a purer kind, called the white petre ; and the other a fouler, called the brown, it is proper to take care, that the first of these kinds be employed ; especially, if the spirit of nitre be used for any such medicinal, or other purposes, as require it to be pure : for the brown nitre being seldom free from a considerable proportion of sea salt, the acid spirit, produced from it, must be necessarily an imperfect aqua regia ; and, therefore, not so fit for gilding, and many other uses.

I shall, therefore, after treating of those processes for the spirit of nitre, which are given under the name of preparations of aqua fortis, endeavour to shew the most expedient and profitable method of obtaining pure spirit of nitre, proper either for those purposes, where it is required to be pure ; or where the mixture of oil of vitriol with it is necessary.

Single aqua fortis.

Take, of crude vitriol, three pounds, of nitre, two pounds : grind, and mix them well together : put the mixture into earthen vessels, called long-necks, which must be filled about two thirds ; and place them in

a reverberatory furnace, made for this purpose: lute on receivers fitted to their necks; after which distill, with a fire gradually raised to the highest degree.

Note.

By the words, aqua fortis, as distinct from spirit of nitre, is to be understood a compound of spirit of nitre, and oil of vitriol: for, from the proportion of the vitriol used, as well in this, as all the other processes given for acid spirits, under the name of aqua fortis, it will be evident, on examination, that a quantity of oil of vitriol must rise along with the spirit of nitre; if the fire be of due strength: as the quantity of vitriol used, contains much more acid, than can be fixed by the alkaline part of the nitre.

This is the process formerly used, for distilling what is improperly called the single aqua fortis; but ought rather to be called the weak: as differing in nothing from that called the double; but in containing more water, on account of the vitriols being used without any previous calcination. This, therefore, renders such a process, in its nature, absurd; as being unprofitable and needless; for, beside the inconvenience, which is liable to happen, from the ebullition of the vitriol, that occasions half the contents to overflow, if the fire be not conducted with a caution more than is practicable, till the water, which assists in forming the crystals of the vitriol, be come over, the long-necks

necks are prevented, from holding the quantity they would otherwise contain, by the greater bulk, which the vitriol has in this state, than when calcined. The nitre is likewise subject to sink to the bottom, when the vitriol is melted into a fluid state; as happens always, in this case, from the water it contains; and this prevents such a due commixture, as is necessary; in order that the acid of the vitriol may act on the nitre, to separate the spirit from it: and, for these several reasons, this process has been greatly disused of late.

But the college of London do not seem to have greatly reformed these errors, of the old process for the single aqua fortis, in the process given last by them for the double; which, according to the old manner of preparing it, was made by means of vitriol calcined to redness. For, tho' they have ordered part of the vitriol to be used uncalcined, and part of it calcined to redness, as it were by mixing the two extremes to find a remedy in each for the other; yet as we shall see, on our remarks on this process, instead of removing these inconveniencies, they have only added others.

Preparation of aqua fortis, according to the dispensatory of the college of London.

Take, of nitre and green vitriol uncalcined, each three pounds; of the same vitriol

vitriol calcined to redness, one pound and a half : mix them thoroughly ; and distill with a strong fire, as long as any red fumes arise.

Note.

The principle, on which this alteration, or rather combination, of the two processes, for the single and double aqua fortis, is grounded, is too mysterious to be understood ; for, though the proportion of phlegm, betwixt this mixture of vitriol wholly uncalcined, and calcined to redness, may not differ greatly from that of vitriol calcined to whiteness : yet, as in the calcination to redness, a considerable part of the acid (as is observed above,) being driven off, to allow for which, the whole quantity of vitriol is here augmented, (the acid of the vitriol being the medium, by which the separation, is made of the spirit from the nitre), this occasions a greater consumption of the vitriol, and a needless filling of the vessel in which they are distilled ; besides the inconveniences liable to happen, from the boiling over of the uncalcined vitriol, and the separation of the nitre from it while melted, without the least convenience or saving to counterballance these disadvantages.

It is, therefore, much better, when the method of making aqua fortis, by means of crude vitriol, is followed (which, as I shall shew below, may be much better changed for another,)

to

to use the due proportion of vitriol calcined to whiteness, as is directed by the college of Edinburgh; and practised by those, who best understand this art: by which not only the ebullition in the uncalcined vitriol, and tediousness of keeping back the fire with great care till all the phlegm be come over, are avoided; but the due commixture of the ingredients is preserved, during the whole operation; and the quantity capable of being distilled in the same vessel, considerably augmented; which, in this case, enhances the profit in a very material degree. But as the proportion of nitre is much too great in the Edinburgh process, the following one, in which all these several errors are reformed, and which is more conformable to the present practice of those, who carry on this art as a manufacture, may be allowed to be the best hitherto given.

Improved process for the preparation of aqua fortis, from nitre and crude vitriol.

Take, of vitriol calcined to whiteness, and of crude nitre, each equal parts: pound, and mix them well together: put them into the iron pot, described as part of the apparatus for this purpose, p. 47; and fit on the head; making good the joint with fire lute; the receiver being also luted

to

to the arms : distill with a fire increased, gradually, to the greatest degree ; and continued as long as any red fumes appear.

Note.

It will be proper here, and in all the distillations of spirit of nitre, to leave a small hole, made with a wire or pin, in the lute of the necks of the receivers ; in order to give a vent for the air, generated by the action of the oil of vitriol on the nitre ; and which, otherwise, will strain, and open, the lute, to the annoyance of the operator, and loss of part of the spirit.

Since the improvement, in the method of obtaining it from sulphur, has so greatly diminished the price of oil of vitriol, this method of using crude vitriol, for the making of spirit of nitre, is rendered much less profitable, than the obtaining it by means of the oil of vitriol. And the making aqua fortis, by any method, distinct from that used for spirit of nitre, is also needlessly troublesome : for, as the difference of them wholly consists, in the addition of oil of vitriol to the other ; when the spirit of nitre is obtained, the oil of vitriol may be added to it, in any proportion found necessary ; and it may be then extemporaneously changed into any kind of aqua fortis ; and the same end consequently answered with greatly less trouble and expence.

I shall, therefore, subjoin the best method of procuring pure spirit of nitre, by means of oil of vitriol: which may be used, in that state, by the refiners, gilders, &c. to whom the purity is of the highest consequence; and commixt with a due proportion of oil of vitriol, for the use of the brass founders, dyers, &c. to whom this compound, or the aqua fortis, as it is called, is necessary.

Best method of procuring pure spirit of nitre, for the purposes of gilding, refining, &c. and which may be, likewise, on all occasions, converted into any kind of aqua fortis.

Take, of crude nitre, (called rough petre), the white kind, twenty four pounds: put it into a retort of a proper size; and add to it of oil of vitriol, twelve pounds: fit on a very large receiver, first pouring into it six pints of water: distill them with a fire gradually increased to the highest degree.

If the spirit be required to be exceeding strong, a pint or two of the water, directed to be put into the receiver, may be left out.

Note.

This is the proper proportion of the oil of vitriol to the nitre, for obtaining the spirit of nitre,
in

in the greatest degree of purify, in which it is commonly had; and which, in this state, is fit for the uses of the gilders and refiners: but as it is very necessary, for the solution of silver to make the lunar caustic, and for many other purposes, in arts and manufacturers, to have it perfectly pure, I will here give the method, used by the refiners, for that purpose; which at the same time supplies the means of discovering, and remedying, the impurity of it in the most accurate degree.

Method of proving, and purifying, the spirit of nitre.

Take a small quantity of spirit of nitre: dissolve in it as much silver, as it will take: put a few drops of this into some of the spirit of nitre, that is to be proved; and, if the spirit remain transparent, it may be concluded to be pure; but, if a white cloudiness be perceived, which will afterwards form a sediment, it may be, with certainty, inferred, that there is some commixture of oil of vitriol, or spirit of salt, with it.

In order, therefore, to render the spirit of nitre absolutely pure, drop the solution of silver gradually into it, so long as it shall produce

produce the least turbidness ; time being given for the spirit to become clear betwixt each addition : the spirit of nitre, being then poured off from the sediment, will be perfectly pure : and if this sediment, which is the silver precipitated, be evaporated to dryness, and then fused in a crucible, with a small quantity of fixt alkaline salt of any kind, it will be reduced to its proper metal-line state.

Note.

By this method, spirit of nitre may be rendered, with very little trouble, or expence, of an absolute purity ; and fit either for the solution of silver, or any other experimental, or useful purpose, where such purity is necessary : but, as the commixture of a certain proportion of oil of vitriol with it, is equally requisite for some purposes, as its being intirely free from that acid is for others, I will subjoin a simple method, of changing it into double or single aqua fortis ; which, as we observed before, are only compositions from these two acids.

Method

Method of converting pure spirit of nitre into double or strong aqua fortis, proper for the use of founders, &c. in cleansing brass work after it is cast ; as also for engravers and etchers of copper plates.

Take, of the pure spirit of nitre, nine pounds, of oil of vitriol, one pound : mix them together.

Note.

The spirit of nitre, if made expressly for this purpose, may be prepared, with fourteen pounds of oil of vitriol, instead of twelve to twenty four of the crude nitre : and, in this case, only half a pound of the oil of vitriol must be added afterwards.

This is the only purpose where double aqua is necessary : but, as the single is used on many different occasions, and particularly by the dyers, in very great quantities, it is proper to shew, how it may be best made from the pure spirit of nitre.

Method of converting the pure spirit of nitre into single aqua fortis, for the use of dyers, &c.

Take, of the pure spirit of nitre, twenty pounds, of oil of vitriol, seven pounds :
mix

mix them well together ; and add of water thirty pounds.

Note.

This mixture is particularly accommodated to the purposes of dyers : but, it will answer extremely well, also, to those, who use single aqua fortis, for mixing with water, in order to the cleaning copper, or brass work : and will be found no way different from that distilled immediately from an equivalent proportion of nitre and vitriol. It is, if made in the above proportion, near the standard of the best Dutch aqua fortis, usually sold to the dyers : but that may be easily regulated, if there be occasion to make it correspond with any fixt price, by the reducing it lower by the further addition of water : and it may be compared, accurately enough, with any other, by means of their specific gravity ; which may be found, by filling a small glass globe, having a narrow neck, with each kind ; and observing their agreement, or difference, on weighing them in a pair of small scales.

By this treatment of the aqua fortis, it may be afforded, with considerable profit, at a much lower rate than it is supplied from Holland : especially by those, who manufacture the oil of vitriol themselves, according to the new method : or it will very well answer for dyers, or others, who use great quantities to make what they use themselves, (which, according

to the process above given, may be managed in a very small compass) : particularly, while oil of vitriol shall continue at the low price of four pence per pound.

Spiritus nitri dulcis, or dulcified spirit of nitre.

Take, of rectified spirit of wine, two pints, of Glauber's spirit of nitre, (that is to say, the kind made with oil of vitriol) half a pound : mix them, by pouring the spirit of nitre on the other ; and distill the mixture, with a gentle heat, as long as what comes over will not raise any fermentation with alkaline salts.

Note.

The proportion of half a pound of the spirit of nitre, to two pints of the spirit of wine, is much too great : for, as it is particularly intimated, by the caution, not to suffer the remaining spirit of nitre to rise after the spirit of wine be come over, that redundant acid is injurious to the dulcified spirit, it is, consequently, unnecessary to use more than the quantity of spirit of wine can carry over with it ; which will be less than half this proportion : and this diminution of the quantity will suffer the whole to be drawn over, without the trouble

trouble of watching the critical point; or making experiments with alkaline salt.

It is necessary to be extremely cautious, in making the dulcified spirit of nitre, as well that as of vitriol, in mixing the ingredients together: especially, if the spirit be highly rectified: for an explosion frequently happens; particularly, when near the whole quantity of spirit of nitre has been added to the other. It is best, therefore, to put in only very small quantities at a time; and to let the mixture stand, after each addition of the spirit of nitre, till no heat appear to remain; or even to arise on shaking the vessel.

The distillation of dulcified spirit of nitre is best performed in retorts, placed in the coolest part of the sand bath, with very large receivers fitted into them.

The dulcified spirit of nitre is very frequently adulterated with water, from which the unso-phisticated may be best distinguished, by the strength of that peculiar and grateful scent, this composition has, when duly prepared; and which is always proportionably abated by any addition of water; and almost wholly destroyed, when lowered beyond that degree of strength, called proof, in the spirit of wine.

Sal prunellæ.

Take any quantity of salt-petre: melt it in an earthen pot, or clean iron kettle:

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when it is well melted, cast a little of the flowers of sulphur upon it ; and, when that is burnt, put on more ; and continue to do so, till the nitre flow as clear as rock water, without any scum : then, with a clean iron, or brass ladle, take it out of the pot ; and put it into a warm brass pan or mold : when that is fixed, put it by ; and, with the ladle, take out more, till the melted salt be all cast ; which keep for use.

Note.

This is the old process for sal prunellæ. The Edinburg college have fixed the proportion of sulphur to be one ounce to two pounds ; which makes the medicine, then, a compound of two salts : for the greatest part of the nitre will be left unchanged ; and mixed only with so much of a new salt, as that proportion of sulphur could act upon, and convert into one.

In the above process, by melting, must be understood the fusion of the nitre ; as no fluid is to be added to it to dissolve it : and, as this requires more than the first degree of red-hot heat, earthen pots will be scarcely found able to endure so strong a fire, without cracking ; and, as to the iron kettle, I do not see how that can be conveniently put into the fire : besides,
that

that the nitre, before the sulphur be added to it, will calcine the iron, or any other metal, except gold or silver, by deflagrating with the sulphur contained in it. It is, therefore, better, to perform this operation in a large crucible.

When sal prunellæ is made with the proportion of sulphur above directed, it is, as I have shewn before p. 82, exactly the same with the vitriolated tartar, sal polychrestum, and sal enixum ; that is to say, it is a neutral salt, formed from fixt alkaline salt, and the acid of vitriol. As these salts are, therefore, all the same, except, as to the different method of obtaining them, that, which can be cheapest procured, may be substituted for the other ; and the caput mortuum, after the distillation of spirit of nitre, by means of oil of vitriol, may be formed into sal prunellæ as well as tartar vitriolate, by a proper change of the method ; which may be the following.

Method of forming sal prunellæ from the sal enixum, or caput mortuum, after the distillation of spirit of nitre, made with oil of vitriol.

Take any quantity of the sal enixum, or caput mortuum left after the distillation of the spirit of nitre ; and, if it be acid, add to it a small quantity of fixt alkaline salt :

put it into a crucible ; and give it a heat sufficient to fuse it, or make it run into a fluid state : but if, on trying, in this state, it yet appear acid, more of the fixt alkaline salt may be added, till no acidity remain. It must be then cast into molds ; or, what is more convenient, poured out, by small ladle-fulls, on a smooth copper, or iron plate ; which will form it into thin cakes ; such as are usually seen in the shops. If any brown colour appear in it, a little nitre may be added to it, while in this state of fusion ; which will bring it to perfect whiteness.

Note.

If the sal prunellæ be desired, to be such a compound of the two kinds of salts, as the process of the Edinburg college seems to intimate to be proper, a proportion of nitre may be added at pleasure to this salt, while in a state of fusion, which will effect the same, as if the sal prunellæ were made from nitre and sulphur, in an equivalent proportion.

Sal polychrest.

Mix equal parts of sulphur and nitre, in fine powder ; and put them into a red-hot crucible,

crucible, by a spoonful at a time ; observing, as soon as the explosion caused by one spoonful be over, to put in another ; and continuing to do so till all the mixture be used : put then a tile over the top of the crucible ; and, covering the whole over with coals, keep the salt in fusion four or five hours : then pour it into a warm copper vessel ; and, when cold, powder and dissolve it in warm water : filter the solution ; and evaporate till it be dry.

If this salt be not so white as desired, put it again into a crucible ; and set it in a strong fire for three or four hours longer ; continually stirring it till it be very white : then again dissolve, filter, and evaporate to dryness.

Note.

This is the common process for making this salt : but it is not a very good one. The keeping this salt in fusion so long is wholly unnecessary ; for it is properly formed as soon as the explosion ceases.

The forming this salt into crystals is wrongly omitted : for, if it be required only in a dry mass, improper substitutions will be sold in its place ; against which, the particular appearance

of the chryftals, when once known, is a fecurity. But, as, probably, fuch fubftitution will be the unprepared caput mortuum, after the diffillation of fpirit of nitre, it may be diftinguifhed by its acid tafte; which fhould be wholly wanting in the fal polychrefte.

As this, no ways, differs from the tartar vitriolate, it is unnecelfary to repeat here again, in what manner it may be moft profitably and perfectly prepared; as, what is before faid on that article, may be confulted with regard to this.

Sal mirabile, or Glauber's falt.

Take, of clean fea falt, fountain water, and oil of vitriol, each two pounds: mix the oil of vitriol, with the water, thus. Firft put the water into an earthen veflel; then put the oil of vitriol to it, by two or three ounces at a time; for, if more be put in together, it will endanger the breaking of the veflel, by the violence of the heat that will be produced: put, then, the falt into a retort, fet in a fand-pot; and add the oil, and water, to it; fit on a receiver, and diffill with a fire gradually increafed to the greateft degree. Take the falt left in the retort after the diffillation; and diffolve it
in

in water : filter, evaporate to the due point, and set the solution, to form chrystals, in a cold place.

Note.

This is the old process for Glauber's salt. The college of London have reduced the quantity of water to one half; which is very proper : because the real use of it, being only to render the fumes of the spirit of salt more condensable, a redundant quantity only protracts the operation, by making a longer distillation necessary.

The college of Edinburg have diminished the quantity of oil of vitriol to one half; which is, certainly, a much better proportion than that of the college of London. With respect to the quality of the Glauber's salt produced, it is wholly indifferent what quantity of sea salt is used ; but, with respect to profit and expedience in the operation, it is far otherwise : for, if the quantity of oil of vitriol be greater, than is sufficient to expel the acid of the salt, it will require a great degree and continuance of fire, to drive it over ; and, when the salt is freed from it, as well as it can be, by the heat of a sand furnace, it will render the solution so acid, that the chrystals will take a very long time in drying ; and be themselves too acrid, from the acid which will remain with them, for the intension of the medicine. The best proportion, therefore, that can be settled, is,
by

by adjusting the quantities in such manner, that there may be a small quantity more of the oil of vitriol than can be fixed by the alkaline basis of the sea salt; which, according to the present standard of oil of vitriol, is about nine ounces of the oil of vitriol to a pound of the sea salt: and, if the Glauber's salt produced should not shoot freely, as will sometimes happen, if the solution be wholly void of acid, a little oil of vitriol may be added; which will certainly answer that purpose the same, as if it came out of the retort with the salt.

The use of an earthen vessel, in the above process, is wrong: for all earthen vessels make a waste of fluids put into them, if they be not glazed; and such as are so, are liable to have the glazing immediately corroded and eaten off, when acid spirits of any kind are put into them.

This medicine, though of great importance in practice, was, for several years, almost excluded by the substitution of a counterfeit kind, made first at Limington, and afterwards elsewhere; of which, I shall speak more particularly below: but the use of this counterfeit, being in its turn superseded greatly by the late improvements made in the preparation of the genuine kind, and the easy method of obtaining oil of vitriol from sulphur, by which they have reduced the wholesale price even to four pence per pound, I will show the most expedite and cheap methods, by which, the true kind is, or may be made.

Most profitable and easy method of preparing the true Glauber's salts, by means of the apparatus described p. 33.

Take, of sea salt, twenty four pounds ; and put it into a retort of a proper size : add to it, of oil of vitriol, fourteen pounds, mixed, very gradually, in a glass receiver, with ten or twelve pints of water : set the retort in a sand-pot ; and let it stand there for some hours the mouth being stopped with paper : distill then, with a heat gradually raised to a pretty strong degree, till no more fumes come into the receiver : after the furnace is properly cooled, take the cake of salts out of the retort ; and dissolve it, in boiling water, in case of very large quantities in the leaden boiler described p. 33, or, otherwise, in a large pipkin of stone ware : filter the solution through earthen cullenders ; and put it either in the leaden vessels, or large receivers, above described : and let it stand to shoot. After the chrySTALLIZATION is finished, which must be concluded from the
chrySTALS

chryftals not appearing to grow bigger, the mothers (or fluid remaining after the fhooting of the falts) muft be poured off from the falts in the receivers; and the falts fet to drain in the earthen cullenders, or proper baskets; or, if in the leaden ciftern, they muft be taken out into the baskets, provided for this purpofe; and, when drained there to a proper degree, laid on the frame of basket work to dry.

Note.

By this method, if the oil of vitriol continues at the very low price, for which it is fold at prefent, the true Glauber's falt may be made at fo cheap a rate, that one may hope to fee intirely rejected the counterfeit kind, known, among the dealers in medicine, by the name of the Lymington falts, and fold in the fhops under the name of Glauber's falt; of which name, the genuine kind was fo much robbed, that it was diftinguifhed from this by the name of fal mirabile: but, as there yet remains fome demand for them, either amongft thofe, who are ignorant of the real difference betwixt them and the true kind, or who are induced, by fome fmall advantage in the price, to prefer them, I fhall fhew what they really are; and how converted into that form, which makes them pafs for the genuine kind.

Method

Method of producing the Lymington, or counterfeit Glauber's salts, from the sal catharticum amarum, or Epsom salt, as it is called in the shops.

Take the Epsom salt, (which is the sal catharticum amarum, shot into chrystals from the bittern, or mothers of the sea salt, when obtained from sea water); and dissolve it in boiling water : put it into proper vessels ; adding, to every gallon of the solution, an ounce or more of oil of vitriol : let the chrystals form ; and then take them out, and dry them. This may be done, also, with the bittern itself ; and the counterfeit Glauber's salt produced, without any previous formation of them into the fictitious Epsom salt.

Note.

The sal catharticum amarum, treated in this manner, resembles greatly the appearance of the true Glauber's salt ; and, as it is to be obtained, in very great quantities, from the mothers, (or fluid remaining after the chrySTALLIZATION of the sea salt, when made from sea water,) by this simple and cheap process, it was sold
for

for so low a price, that the ignorant and greedy traders in medicine soon received it, after its first invention, in the place of the genuine sal mirabile : the use of which, it almost excluded, till the later improvement restored it by reducing the price nearly to a level with this. As this counterfeit is, however, in no degree comparable to the true kind as a medicine, being nauseous to the stomach, and apt to produce a violent sickness and gripings, I will give an infallible method of distinguishing the one from the other : that they, who are desirous, may not have this substitution imposed upon them, through ignorance of the means of discovering when it is attempted.

Method of distinguishing the Lymington, or counterfeit, Glauber's salt, from the true kind.

Take, any quantity of the suspected salt ; and dissolve it in clean water : and, when the solution is become clear, and limpid, add to it a small quantity of the solution of salt of tartar, or any other fixt alkaline salt, made clear likewise : if no change happen on the commixture, but the mixt solutions continue to be as clear and transparent as when separate, it may, with certainty, be concluded,

cluded, that the salt, thus examined, is the true Glauber's salt : but, if a milky turbidness appear, which will afterwards be succeeded by the precipitation of a powder, it may thence be known to be the Lymington counterfeit. On the want of fixt alkaline salt, to make this experiment, volatile salt may be used, in its place, with the same effect.

Note.

By this method, the true sal mirabile may be always known from this counterfeit, by those who are unaquainted with either kind : but those, who are more conversant with matters of this nature, may easily distinguish them from each other, by a bitter styptic taste, which the Lymington salt has in a much greater degree than the other ; and by the form of the chrystals ; which in the true Glauber's salt are longer, and more of the figure (as it were) of long square needles.

Magnesia alba.

Take, any quantity of the mothers, or fluid remaining, after the chrySTALLIZATION of the salt-petre, in the refinement of crude nitre : add to them, gradually, a solution
of

of fixt alkaline salt, as long as any effervescence, or white turbidness, appear to be produced. By these means, a white powder will be precipitated: which, being separated from the fluid, freed from the remaining salt by washing, and afterwards dried, is the original magnesia alba.

Note.

This is the true and original process, by which the magnesia alba of Hofman was made: but, as very little earth is to be obtained from nitre, other precipitations have been made from substances, which afford it copiously; and have been substituted in the place, and wholly excluded the use, of this. That, which has most commonly been practised, is as follows.

*Method of making the fictitious magnesia alba;
which is the only kind used here.*

Take, of the sal catharticum amarum, or Epsom salt, any quantity: dissolve it in water: dissolve, also, half the same weight of pearl ashes; and filter the solution. Add the solution of pearl ashes to that of the Epsom salt; at first in pretty large quantities,

ties, but afterwards more gradually, so long as any effervescence, or turbidness, appear to ensue the admixture. After the powder, which will be, by this means, precipitated, has wholly subsided to the bottom, and the fluid become clear, decant off, all that can be separated, from the powder; and put the remainder, together with the powder, into an earthen filter, with paper, and a linnen cloth over it: when the fluid is thus further separated from it, and it is become of a proper consistence, lay the powder on a board, or chalk stone, to dry.

Alum has been, also, used instead of the Epsom salt; and will afford a white earth, by the same treatment: but the two earths are very different in their nature.

Note.

This is the process, by which the magnesia alba, sold here during the vogue, in which this medicine was some time ago, was prepared, by some considerable dealers in drugs and chemical preparations, who pretended they imported it from Hamburg. This earth is not the same with that obtained from the nitre: but, for any thing that appears to the contrary, may answer the same end; as it is, by no means, evident,

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there

there is any efficacy in either, which does solely lie in the alkaline quality, they possess, in common with all other cetaceous or testaceous bodies.

As the magnesia alba has been recommended, as having a cathartic power, on children, along with that of absorbing acids, it is better not to free the earth from the salts, formed in the preparation, by any subsequent additions of water to it in the filter : for the salt produced, being the same with the sal polychrest, vitriolated tartar, &c. will contribute to the cathartic effect : or, indeed, must be the only cause of it ; unless where the earth, meeting with a considerable quantity of acid, in the intestines of those, who take it, may be converted into a neutral salt ; which will, consequently, have this power.

Spirit of sulphur by the bell.

Take any quantity of sulphur ; put it into an earthen dish, placed upon an inverted crucible : set them both, upon the bottom of a large earthen vessel, in a moist place, secured from the wind ; and then fire the sulphur with a red-hot iron ; and hang over it a glass bell, at such a distance as to be out of the reach of the flame ; the vapour of the sulphur will condense in the
bell ;

bell ; and flow down the sides of it, like water, into the vessel underneath.

Note.

The spirit, thus obtained, will no way differ (as was before shewn p. 80) from pure oil of vitriol of the same strength : and the acid, now sold under that name, is, (as we have before seen,) prepared from sulphur by parallel means. But, as the college of London have thought proper to give this process; and, thereby, seem to intimate, the spirit of sulphur, by the bell, may be esteemed a different medicine, and, as, many from that authority, or their own attachment to former usages, may chuse to have spirit of sulphur prepared in this manner, I shall subjoin a much more expedite and profitable method than the above, for conducting this process, by increasing the quantity of condensing surface ; and by determining all the fumes of the sulphur to pass into the condensing vessel ; both which are wanting, when the common bell is used.

An expedite and profitable manner of making the spirit of sulphur by the bell, by means of the apparatus described p. 48.

Put the glass plate over the mortar ; and set the drinking glass, inverted, in the middle of

it: put, then, a proper quantity of sulphur into the small earthen dish; and place it on the bottom of the inverted glass: suspend the retort, over these other vessels, in such manner, that the plate, containing the sulphur, may be put within the hole in the bottom of the retort; space being left for the air to enter freely, on every side the dish, into the cavity of the retort. The tubulated receiver must be then fitted to the retort, and the joint luted: after which the sulphur must be fired; and the fumes will be condensed into spirit; partly in the retort, which will drop thence on the plate, and run into the mortar; and, partly, in the receiver. When the quantity of sulphur in the dish is consumed, it must be renewed; or, if, by accident, its fire be extinguished before the whole be burnt away, it must be rekindled by means of a red-hot iron.

Note.

Those, who are solicitous to have the spirit of sulphur prepared by the regular process, may easily procure it by these means: but it is not to be expected from shops or dealers; the oil of

of vitriol, diluted with water, being universally substituted for it : and, as they are, excepting accidental impurity, the same, there is no way of distinguishing the one from the other.

Lac sulphuris.

Take, of sulphur, any quantity, of quicklime, thrice the weight of the sulphur : boil them, till the sulphur be dissolved ; and filter the solution through paper : make a precipitation with weak spirit of vitriol ; which precipitation is to be made perfectly insipid by frequent washings.

Note.

This is the process of the college of London ; and directs a much cheaper and shorter method, than the old one of using salt of tartar instead of the lime.

It is, however, erroneous, with respect to the quantity of lime : as half the quantity, there prescribed, or less, will be sufficient to cause the solution of the sulphur ; with which intention alone, the lime is used ; and, as, by thus increasing the volume of the feces, (which the lime may be allowed to be called, after it has answered its purpose, in making the water dissolve the sulphur), the filtration of the solution

is rendered very tedious ; and attended with a considerable loss, from the quantity of fluid, which remains absorbed, in the great mass of lime, after it has been as well drained, as it can be in any moderate time. The following process, therefore, may be considered as preferable to the above.

Improved method of preparing the sal sulphuris.

Take, of quicklime, seven pounds : put it, gradually, into a proper boiler, containing three or four gallons of water : when the lime is quenched in the water, add to them, of crude sulphur, five pounds : and boil the mixture three quarters of an hour, or an hour : the sulphur being, then, dissolved in the water, filter the solution, through paper, in an earthen cullender ; and, when the fluid is so drained from the lime, that the filter ceases to run freely, put water to it, in the filter, to drive through as much more as possible of the remaining part of the solution. To the solution, thus separated from the lime, add oil of vitriol, or spirit of salt, very gradually, as long as it shall appear to have any effect on the fluid, by exciting any effervescence, or producing any
turbid-

turbidness ; and when the powder, which will be, by this means, precipitated, has subsided to the bottom of the vessel, take away as much of the fluid, as can be poured off clear, by decantation ; and free the powder from the remaining part, by filtering with the earthen cullender through paper, a linnen cloth being put over the paper : when all the fluid has drained from the powder in the filter, put it into a quantity of fresh water ; and proceed, by decantation and filtering, as with the first quantity of fluid, till the powder be a second time freed from all the fluid, except what its own mass absorbs : fill up the filter, then, with fresh water ; and, when that is drained off, repeat the same : after which, lay the mass to dry, on a proper board, in small pieces.

Note.

By pursuing this method, more lac sulphuris will be obtained, from any quantity of crude sulphur, than when a greater proportion of lime is used : and the washing it, in this manner, will free it from the salts effectually. It is, however, very usual to omit the washing : by which omission, not only so much trouble is spared,

but a gain arises from the salts left behind, as they add to the weight : but this neglect may be easily perceived, by a roughness, that appears, from it, in the lac sulphuris, on its being rubbed betwixt the fingers ; as, also, by the abundance of shining particles, which may be seen in it.

It is too common, likewise, to adulterate this medicine by chalk, lime, calcined oyster-shells, or other cretaceous bodies : which sophistication, or any other, by heterogeneous matter, may be detected by the following means.

Method of discovering the sophistication of lac sulphuris.

Take any quantity of the lac sulphuris, that is suspected ; put into a crucible ; and put a less crucible, reversed, on the other, as a cover, but without any lute : place them in a common fire, where there is a sufficient heat to sublime the sulphur : continue them there, till the sulphur be wholly sublimed ; which may be perceived by the fumes ceasing to arise. If the lac sulphuris be pure, there will be no recement, or caput mortuum, left in the crucible : but, if there be any adulteration, the matter of it will be left in the crucible ; and, by weighing, or other proper trials.

trials, either its quantity, or nature, may be known.

Salt of amber.

Take, of white amber, one part, of clean sand, three parts : being mixt, put them into a glass retort, of which they will fill one half : then fit on a large receiver : and distill, in a sand-heat, with a fire gradually increased : at first a spirit will come over, with some yellow oil ; then a yellow oil ; after which, the heat being increased, more salt will rise, with a redish oil : when the distillation is over, empty the fluid out of the receiver ; and, having collected the salt, which adheres to the sides, dry it by a gentle pressure betwixt the folds of spongy paper. The oil may be separated from the spirit, by filtering ; and afterwards rectified, by distilling it from some brine of sea salt.

Note.

This is the process of the Edinburg dispensatory ; and the best, upon the whole, hitherto given : but it is, nevertheless, improper in some particulars ; and too inexplicit as to others.

The

The addition of sand, in the distillation, is unnecessary, and better omitted : for the only use of it, is to keep the melted amber from rising over the neck of the retort : but a too great ebullition may be easily avoided, by the proper management of the fire ; without which, the sand itself will fail in preventing this consequence.

The insisting on white amber, is without any ground : for, though that sort be generally dearer than the other, yet the blacker kind sometimes affords an equal, or greater quantity, of salt ; and is, in other respects, exactly the same with relation to this preparation. The great secret in preparing this medicine cheap, does, indeed, lie in the choice of the amber ; as some parcels afford, greatly, more salt than others : but this difference is not discovered, either by the colour, or any other apparent quality, hitherto known : on which account, the best way is, to try, by a moderate quantity, what any parcel will afford ; and to purchase the whole, if it be found good ; or otherwise to reject it, and try some other.

The retorts used, for this operation, should be made with long wide necks, cut to a very large orifice ; that the salt may be taken out before the brown oil arise ; which may be done by a small wooden spatula.

The salt, which comes after, along with the brown oil, may be put into the phlegm, that is improperly called the spirit, (being only water impregnate with the salt) : and, this phlegm,
being

being freed from the oil, and afterwards exhaled, in balneo mariæ, the remaining salt may be mixed with that, which was at first taken out of the neck.

The college of London, in their dispensatory, direct the salt to be boiled, either in the spirit, which comes over with it, or in water; in order to free it, more effectually, from the oil adhering to it; and even seems to intimate a repetition of this operation: but, as this causes an additional trouble in dissolving the salt, and evaporating the fluid, to bring it back to a proper form; and tends, also, to a diminution of the quantity, as well by taking away the oil, as by the waste, which this treatment will unavoidably occasion, it is seldom practised: and, with regard to the perfection of the medicine, the omission of this part of the preparation is, perhaps, rather meritorious, than condemnable: for it is a great question, whether the salt of amber does not owe a principal share of its efficacy, to the oil, which is mixt with it; and, certainly, if so, the cleansing it, more than is done by means of spongy paper, may be rather a detriment than an improvement.

The salt of amber, being a very dear medicine, is very frequently adulterated: and the most usual substances, with which it is sophisticated, are cremor tartaris and sal ammoniacum.

But these frauds, or, indeed, any other, committed on this medicine, are easily detectable, by the following means.

Method of detecting any adulterations of the salt of amber.

Take a small quantity of any parcel suspected ; and mix it with moist soap, of any kind. If it be adulterated with sal ammoniacum, a smell of volatile salt will immediately be discernible : from whence the sophistication, with the sal ammoniacum, may be positively ascertained.

If it stand this trial, and no pungency, like that of volatile salts, ensue, take another small quantity ; and lay it on a poker, heated almost red-hot : by which means, the salt of amber will be dissipated in fumes ; and the heterogeneous matter left behind : which, if it be cremor tartaris, will appear in the form of a black or coaly powder ; if any other neutral salt, in a white one.

Note.

These two experiments are fully conclusive, with respect to the genuineness of salt of amber ; for it can be adulterated with nothing, that has a volatility in a degree near its own, except ammoniacal salts, which will, always, shew itself,

itself, by the appearance of a volatile pungency, on its admixture with the solution of fixt alkaline salt, either in soap, or any other way : and, if it be not adulterated with some body volatile, like itself, the application of that degree of heat, which will sublime it, will, consequently, separate it from the sophisticating matter ; and leave such matter, subject to any further examination, which shall be thought proper.

Oil of amber.

Take any quantity of the oil, as it comes over, in the distillation of the amber for the salt ; and put it into a retort, with four times its weight of water : fit a large receiver to the retort ; and give a heat, just sufficient to keep the water boiling : continue the distillation, till a great part of the mixture be come over : when, the receiver being taken away, the rectified oil must be separated from the water. If the oil of amber be desired very limpid, the rectification must be repeated.

Note.

The Edinburg college direct this operation to be performed with brine of sea salt : but water will answer the end equally well ; if the
heat

heat be kept from rising above the due degree ; and the retort be made of a long form, having its neck placed so depending in the furnace, as to return a great part of what is condensed in it again into the body of the retort.

Though the oil of amber be thrown away in great quantities, by those, who make the salt ; yet, to avoid the trouble of the rectification, it is very usual to adulterate it by the admixture of the oil of turpentine : which it is very difficult to discover, unless by the smell. It is, however, a blameable practice ; and ought to be guarded against ; as the oil of amber has medicinal qualities different, at least in the degree, from the oil of turpentine : and, tho' the latter will not in the least counteract the intention of the former, yet it perverts the due proportion of the dose ; and eludes, in that respect, the design of the prescriber.

The oil, distilled from coal, treated, for that end, in the same manner as amber, has been substituted for the oil of amber ; and is said to be the same : but at present the small consumption of the oil of amber, the plenty of it with those, who prepare the salt, and the increase of it in the hands of others, by the addition of oil of turpentine, have taken away the temptation, which Wilson, who introduced this substitution, might have, in his time, for practising it.

Method

Method of making yellow arsenic.

Take, of arsenic powdered, one pound, of flowers of sulphur, half a pound : mix them well, and sublime them, in a cucurbit, of an oval form, in the sand-pot designed for the sublimation of calomel ; keeping up the fire as high as may be, without forcing out the fumes from the mouth of the cucurbit : when the whole is sublimed, which may be known by the abatement of the heat in the upper part of the cucurbit, the fire must be discontinued ; and the cucurbit broken, when cold, to take out the cake of yellow arsenic.

Note.

This substance is not used in medicine ; nor much for any purpose, but in the dying the colours called Saxon blue and green : for which, at one time, it was greatly wanted ; and fetched from abroad, at a very considerable expence : to avoid which inconvenience to the public for the future, I have inserted this process, by which it may be made, with very little expence and trouble, here,

SECTION

SECTION IV.

Of the preparation of those medicines where metalline substances make the whole, or principal part of the subject.

Purification of mercury.

Distill the quicksilver, in a retort ; and then wash it well with water and salt, or vinegar.

Note.

This is the direction of the college of London. But the distillation of the quicksilver in a retort is hardly practicable : for the great heat, and density, of the fumes, when collected against the sides of the neck of the retort, heat it so unequally, that it is scarcely possible to prevent its being cracked, and falling to pieces, during the operation : and there is, indeed, another reason against the use of a retort ; which is, that a sand heat is scarcely sufficient to raise the fumes of the mercury into the depending part of the neck of them ; and the using them coated, and in the naked fire, is attended both with much trouble and hazard. If, however, a retort be used, it should be of a low round form ; and placed so in the furnace, that

that the neck, which should also be very short, may be as depending as possible, that the quicksilver may not lodge in it; but fall, as it collects in drops, instantly into the receiver; which should be half filled with water, before it be put to the retort. The method, below given, saves all this trouble; avoids the hazard; and may be performed any where, with a common fire, without employing a furnace.

The washing the quicksilver in salt and water, or vinegar, after the distillation, seems intirely needless and ineffectual; for the mercury will certainly be freed from any adulterate mixture, by the distillation: and, if it were not, the washing in brine, or vinegar, could not avail, in the least, to that end.

More expedite method of purifying quicksilver, by means of the alembic described p. 43.

Take any quantity of quicksilver; and put it into the iron alembic, directed to be made for this purpose: the stopper being skrewed in to the hole at the top, place it on a culinary fire, raising the coals round it: let an earthen pot, filled with water, be so placed, that the bended end of the iron tube of the alembic may lie immersed, two or three inches within the water; and

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the fumes of the quicksilver will be then condensed in the tube ; and run down into the water : when the whole is distilled, which may be easily perceived by the quicksilver's ceasing to drop into the vessel of water, the stopper may be taken out ; and the alembic replenished at pleasure, without taking it from the fire.

Note.

By this method, very great quantities of quicksilver may be distilled, without the least trouble or expence : and this operation ought, therefore, to be always previously practised on the quicksilver, of which the ethiops mineral, alcalizate mercury, and precipitates of every kind, are prepared ; or in case of any other preparation, where there is no subsequent sublimation, in order to free the quicksilver from those almost constant adulterations, that are made on it ; and which may be distinguished, by the method below given, where we treat of the sophistication of simples ; and the means of detecting them.

Corrosive mercury sublimate.

Take, of purified quicksilver, forty ounces ;
 of sea salt, thirty three ounces, of nitre,
 twenty

twenty eight ounces, and of green vitriol calcined, sixty six ounces : let the quicksilver be mixed, in a vessel of stone, or wood, with one ounce, or more, of mercury sublimate already made, and broken into small grains : then let it be ground with the nitre, and afterwards with the sea salt, till there be no longer any appearance of quicksilver : when add the calcined vitriol ; in the commixture of which, with the others, the operation should not be too much prolonged ; lest the quicksilver re-vivify, or reassume its fluid state : lastly, sublime the mixture in a glass mattrass ; to which, at discretion, a proper head must be fitted, to save the spirit ; of which a small quantity will rise.

Note.

This is the process of the college of London ; and one of the best for making sublimate, by the means of green vitriol and nitre.

The greatest difficulty, in this process, is the fixing the quicksilver, in order to its commixture with the other ingredients ; which is very troublesome. An ounce of sublimate, already made, and broken into small grains, is ordered to be used for this purpose ; but it is better to

take a greater quantity, to reduce it to powder, and to moisten it with spirit of salt ; by which means, this tedious operation may be much shortned.

The mattrafs, in which this sublimation is to be made, should not be quite half filled with the ingredients : it should be placed in the pot, in such manner, that the sand may rise round it a little higher than the part of it occupied by the contents.

But, though a mattrafs be here directed, large cucurbits, or bodies, of an oval form, are almost universally used ; and with great reason : for, as only a small quantity of sublimate is produced from this great mass of ingredients, if the vessel, in which the sublimation is made, be not capable of holding a considerable quantity of materials, not only the time, and fire, employed, in obtaining so minute a proportion, but the small size of the cake of the sublimate, render it very disadvantageous. The large sand-pot, and not that intended for the sublimation of calomel, is, therefore, much better accommodated to this purpose : and the cucurbit should be chosen, as large as the furnace will admit ; (for glasses of this form may be blown of almost any magnitude ; and it may be filled, to the height of three quarters, with the materials : the sand being brought round it, something higher than the contents.

But the use of the crude vitriol, in making sublimate, is wholly unnecessary : for it has no effect

effect in the process, but in discharging the spirit of nitre from the salt; which may equally well be previously done, as the Edinburgh process directs; where a solution of the mercury is ordered to be made in spirit of nitre; and the salt produced brought to a dry state, and mixt with an equal quantity of sea salt, and then sublimed: by which method, the volume is greatly reduced; and the sublimate much less liable to be discoloured, or otherwise injured, in the operation.

There is, nevertheless, a much less expensive and troublesome way, even than this, by which the expence of the nitre, and the pains and cost of the operation, for extracting the spirit from it, may be wholly saved. The practice of it has been hitherto confined, I believe, to one place; by persons, who at present are attempting to monopolize this article, with some others: but, for the benefit of the public, I will here lay it open, in the most explicit manner, I can, with the attendant advantages; and particularly recommend it to those, who may erect works for the preparing oil of vitriol from sulphur.

The most cheap and expedite manner of making the corrosive mercury sublimate, by the use of oil of vitriol, alone, with the quicksilver.

Take, of quicksilver, twenty pounds; of oil of vitriol, nine pounds: having put them

together, in a retort; and placed it in a sand-pot, distill till the fumes begin to appear white: take the mass which will be found in the retort, and mix, with it, eighteen pounds of common salt; rubbing them together, till they appear as one body: put this mass into a cucurbit, of which it will occupy something less than three quarters of the cavity; and place it in a sand-pot, to sublime. When the sublimation is finished, take away all parts of the cake of sublimate, which are not transparent, and white.

Note.

By this method, the whole process is greatly contracted, both with regard to time, and the volume which the matter occupies in the subliming vessel; and the sublimate is much less liable to miscarry, in the preparation, than when the crude vitriol and nitre are used: but if any discoloured parts shall happen to be found, they may be employed in making the white precipitate, as directed in the process of the college of London; for which end, it will equally well serve, with that which is of the purest whiteness.

There is another source of profit opened, by this method of making sublimate: for the whole

whole of the recrement, or caput mortuum, left behind in the retort after the sublimation, is the true sal mirabile, or Glauber's salt; and being taken out, and treated in the same manner, as the cake formed in the retort, when the regular process for sal mirabile is performed, (that is to say, dissolved and chrystallized,) it will, in all respects, be the same as if the oil of vitriol and sea salt had been put alone into the retort. It may be proper, however, to put two or three ounces of pearl ashes into the solution of this salt, before it be filtered previously to the chrystallizing; and if the commixture of this alkaline salt produce a white turbidness, it will be proper to add another ounce of the pearl ashes, and to repeat this addition, so long as it produces any cloudiness, or till the sediment, which it causes, become of an orange colour, or brown. The reason of this addition, is to analyze any sublimate, which may remain unsublimed; or may have fallen from the cake, or the sides of the cucurbit, in the taking it out, or breaking the glass: and which, by means of the alkaline salt, will have its elements disunited; the mercury becoming a solid precipitate, and the spirit of salt, the other constituent, combining with the alkaline salt, and forming that salt, which the college of London have honoured, with a special process, under the name of the sal marinus regeneratus. If the destroying the prevalence of the acid, in the solution, by this commixture of alkaline salt

with it, should render the chryſtallization weak, and tardy, an ounce or two of oil of vitriol, dropped into the ſolution, will take away any ſuch reluctance ; and make the ſalt ſhoot as freely, as if no alkaline ſalt had been uſed. There will be gained, by this means, near a pound of Glauber's ſalt, for every pound of the ſublimite ; which will defray the expence of the oil of vitriol, and glaſſes for the ſublimation ; and, together with the great facility, this method affords for the preparation of ſublimite, renders it an article, which may be very advantageous to thoſe, who prepare medicines for wholeſale demands : eſpecially, if they undertake, likewise, to extract the oil of vitriol from ſulphur, by the new method : which, at preſent, would be found attended with great convenience, and profit, to all, who have large elaboratories ; or a demand, either for uſe, or ſale, of any conſiderable quantity of that commodity.

It has been common to praſtiſe the moſt villainous ſophiſtication, with reſpect to ſublimite, which has ever hitherto diſgraced the morals of mankind, by adulterating it with a ſubſtance of the moſt poiſonous nature. I ſhall be ſilent here, as to any further explanation, either of what this ſubſtance is, or how it is to be employed for this wicked purpoſe ; as I would not, on any account, be the cauſe of propagating ſuch deteſtable arts : but, inſtead of furniſhing thoſe, who are ignorant of it, with the method of praſtiſing this curſed ſophiſtication,

phistication, I will furnish a method, by which any person may easily discover, where it has been made ; and have it in their power to reject such parcels of the sublimate, as they find to be of this adulterate kind. This method is as follows.

Method of detecting the adulteration of corrosive sublimate.

Take, a small quantity of the sublimate suspected ; and dissolve it in boiling water : take, also, about double the quantity of any fixt alkaline salt, and make a clear solution of it : mix them together ; and a precipitation will follow ; from which, if it be immediately of a black colour, it may be concluded, that the sublimate was adulterated in the manner suspected ; but, if it appear of an orange colour, it may be deemed free from any such depravity.

N. B. The observation on the colour, as a criterion of this difference, must be made soon after the commixture : for the orange colour will sometimes change to black, on standing a considerable time, even in the case of the best sublimate ; if the fluid, in
which

which the precipitation is made, abound with alkaline salt

Preparation of calomel.

Take, of corrosive mercury sublimate, one pound ; of purified quicksilver, nine ounces : the mercury sublimate being first powdered, put it, together with the quicksilver, into a glass matrafs ; and digest, with a slow heat, in sand, the glass being frequently shaken, till they incorporate : then augment the heat, and sublime them : powder the sublimed matter, having freed it from the acrid upper part, and the globules of quicksilver, if any appear ; and then sublime it again : the sublimation must be six times repeated.

Note.

The repetition of the sublimation seven times is rarely practised ; three, or four, being the utmost, which are afforded in the laboratories for supplying considerable quantities of medicines ; nor can any reason be given, why that number, properly managed, may not reduce the calomel to the same state, as seven hundred.

hundred. It is obvious, that all, which the heat can effect, is the equal mixture of the acid and mercury, which constitute the calomel; and the driving out any redundant part of the first: and, certainly, this may be more effectually done by other means, than the tedious repetition of this troublesome and expensive operation.

The purification of the mercury by sublimation is, also, needless; for nothing, with which mercury can be adulterated, will rise on the sublimation. It is sufficient, therefore, to prove it, by straining a small quantity through leather; and, if no paste like amalgama be found remaining in the leather, but, that the mercury suffer itself to be wholly pressed through, which proves that the proportion of the sophisticated matter, if there be any, must be only small, there can be no inconvenience from using the mercury, though not pure, further than a proportionable defect of the produce of sublimate: but even should a greater adulteration be found, if some of the mercury be put in a crucible into a common fire, and continue there till it be dissipated by the heat, and the caput mortuum weighed, in order to make a proper allowance in the composition of the ingredients, for the defect in the mercury arising from the sophistication, such mercury may be equally well used, as that which is absolutely pure.

There is a flaky laminated appearance in calomel, the dealers in medicines value in it, which

which is owing to the greater proportion of mercury ; and to the briskness of the heat in the sublimation. I suppose the reason for preferring this appearance, is from the experience of its mostly attending that calomel, which they know has undergone, a great number of sublimations : but as it is easily practicable, to diminish the quantity of the acid spirit in calomel, with a much less number of sublimations, this appearance may, consequently, be produced, as well as all the other qualities which are to be desired in this medicine. The following method, in particular, will produce calomel by three sublimations, indistinguishable, in all its properties, from the best that can be made by any repeated number whatever.

More expedite method of producing perfect calomel, where the sublimation is only three times repeated.

Take, of corrosive mercury sublimate, twelve pounds ; of quicksilver, if pure, nine pounds ; or, if otherwise, such a proportion as may allow for the adulteration, which must be previously ascertained : the sublimate, being powdered, divide it into three equal parts ; and put it, with a proportionable division of the mercury, into
three

three mattraffes ; and place them in a gentle sand heat, shaking the mixture frequently ; where they must continue, till they appear to be intirely incorporated : then put the whole together into one mattraffs, of which they will fill about one half ; and place it in the sand-pot, described p. 25 for this purpose ; the mattraffs being immerfed in the sand something more than one half : let the matter be then sublimed with a moderate heat ; and, the sublimation being finished, break the glafs ; and, having taken out the sublimed cake, separate carefully all the yellow parts, if any be found ; and levigate the other, but without moisture, mixing with it two pounds of fresh quicksilver, rubbed to powder, first with half an ounce of sublimate : repeat then the sublimation and levigation as before, adding, at this second levigation, only a pound of the quicksilver treated as before : sublime then a third time ; and levigate, but without any further addition of quicksilver ; and afterwards give the fourth and last sublimation, with the strongest heat that can be used without blowing the fumes of the mercury out of the neck of the mattraffs ;

trass. Take out then any discoloured part ; as, also, the upper part of the cake in the neck of the retort ; if it appear any way to differ in its texture from the rest.

Note.

The calomel, thus prepared, will be as perfectly free from any corrosive qualities, as any number of sublimations whatever can render it: the colour will be perfectly white ; and it will, also, have that flakey laminated appearance, which good calomel is supposed to require.

The fourth sublimation may be spared, by those, who prepare this medicine for sale, if the other parts of the process be duly executed: but, in that case, the third must be performed with the strong heat directed otherwise for the fourth.

The yellow, or other rejected parts of the calomel, may be employed along with the crude mercury: in making sublimate with oil of vitriol.

It has been too usual to adulterate calomel, as well as sublimate, with the poisonous ingredient before mentioned ; and I have seen a recipe, (given by a German empyric, who has for some few years infested this country, and pretends to knowledge in almost every branch of chemistry,) which directed this ingredient to be used in a very large proportion, which, if it happened to be joined to Venetian sublimate, that should contain, likewise, a large proportion
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of

of the same substance, as is frequently the case, a poison, that scarcely the strongest constitution could resist, must have necessarily been produced. The preparers of medicines for the West-India trade, have, likewise, adopted this execrable practice; and, on inquiry, for what purpose the matter of this adulteration was preparing, in a large quantity, the use of it, for this end, has been freely avowed; with the apology, that the calomel would be administered only to negroes. In order, therefore, to prevent such dangerous preparations being imposed on those, who are duly careful, and that they may not be liable to give, perhaps, a scruple of such calomel, as I have seen kill a dog in the quantity of three grains only, though fetched from the shop of a very great dealer in medicines, I will give an infallible method of detecting this pernicious fraud; as the means before directed, to be used for this purpose, with respect to sublimate, are not practicable in the case of calomel, as it is not capable of being dissolved in water.

Method of detecting the adulteration of calomel.

Take a small quantity of the suspected calomel: powder it with about a third of its weight of flowers of sulphur: put the mixture into a crucible, over which a lesser is to be inverted as a cover: place the crucible in a common fire, that it may have a heat sufficient

cient to raise the sulphur in fumes. If the calomel be adulterated, as suspected, a very offensive alliaceous smell, like that of orpiment, will be perceived : but if none such be found to be produced, it may be taken for granted, that it is free from the mixture of the pernicious ingredient, used for its sophistication. This adulteration may be, also, perceived, but with less certainty, by dipping a piece of the calomel, unground, into a solution of fixt alkaline salts ; which, if it be sophisticate, will turn it black ; but, if not, to an orange colour.

Note.

The frequent complaints of tormina, and sometimes even bloody stools, which happen on the taking calomel, are probably more owing to this adulteration, either made, originally, in the preparation of the sublimate, or, afterwards, in that of the calomel, than to any other cause. It is advisable, therefore, always, when such consequences happen, to examine the calomel ; and prove it, by this means : for, where the sophistication happens to be in the sublimate, the most careful and conscientious preparer of the calomel may be deceived : and it is, therefore, very proper, also, that all, who do not prepare the sublimate themselves, which is the case
of

of very few, should examine it by the means above given: as there is no excuse for placing a confidence in the preparations of foreigners; which are imported here in such a manner, that it is impossible to trace back any sophisticated parcel, to the hands of those who practised the fraud: and the invention of this monstrous imposition is of so old a date, that memoirs of it may be found of a hundred and fifty years standing: from whence we may conclude it, to be very well known at present, in all places, where the manufacture of sublimate has been long carried on.

White precipitate of mercury.

Take, of sal ammoniacum, and corrosive sublimate, each an equal weight: dissolve them together in water; and, having filtered them through paper, make a precipitation, with a solution of any fixt alkaline salt: wash the precipitated powder till it be perfectly sweet.

Note.

The use of the sal ammoniacum in this process, which is that of the college of London, is, we are told, to facilitate the solution of the sublimate in the water; to which it is otherwise very reluctant: but it does not appear

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pear to answer, in the least, that end, when carefully tried : nor is there any difficulty in dissolving the sublimate, previously powdered, in a sufficient quantity of boiling water : for, though a large proportion be required, yet that does not produce any inconvenience, in this operation, the removal of which might balance the expence of the sal ammoniacum.

The filtering the solution is likewise wholly unnecessary, if the sublimate and water be clean : nor is it even requisite, when sal ammoniacum is used ; if foul pieces of the salt be not used without scraping.

The solution of the alkaline salt must be added, by degrees, to that of the sublimate ; and with great caution, when near the due quantity has been added : for, if a sufficient quantity be not used, a part of the sublimate will remain in the solution unprecipitated ; and, consequently, be wasted ; and, if more than the proper quantity be used, the colour of the precipitate will be spoilt ; as the smallest excess, in the proportion of the alkaline salts to the sublimate, turns it yellow ; and a greater quantity orange. It is proper, therefore, to reserve some part of the solution of the sublimate ; which being added, may bring back the colour of the precipitate, if it be hurt by an error in this point ; and by thus adding a little of each, as the effect of the commixture may indicate, the due ballance of them may be obtained with great exactness.

But,

But, notwithstanding the college of London have directed this process to be followed, in the making the white precipitate, the produce of which the college of Edinburg have distinguished very properly by the name of the sweet precipitate, there are some, who do not prepare it by this means; but pursue the former method, of preparing it with aqua fortis from the crude quicksilver; that being, all things considered, the cheapest method: as a pound of quicksilver, treated this way, will afford a fourth, or fifth more than its own weight; as the acid of the spirit of nitre, and of the sea salt, employed in its preparation, remain combined with it; whereas, on the contrary, a pound of sublimate will not afford three fourths of its own weight in precipitate; as it is deprived of its acid, by the use of the alkaline salt. There is, also, another reason, why this latter preparation should be followed by those, who make white precipitate for sale; which is, that as the principal demand for it is made by the farriers, who use it as a kind of escharotic, if the other method be adopted, the produce will be rendered wholly unfit for their purpose: for the precipitate is so much deprived of its acid, in which alone the caustic quality of it consists, that they may as well use minium, powdered tin, or any other metallic pulverised body. It was, therefore, very judicious in the Edinburg college, not to reject the old manner of preparation, as the London college have since done; but to retain that, and take in, likewise, the new one; distinguishing

them by the names of white, and sweet precipitate; as their qualities are essentially different; and these names properly significant of that difference: the white meaning the old kind, which is in some degree corrosive, and, therefore, proper to be used externally, and for the purposes of the farriers; the sweet meaning, that it is devoid of any saline nature, or caustic quality, and, consequently, fit for internal use. The old process ought, therefore, certainly, to have a place, as well as the new; and may be best performed in this manner.

Most expedite method of preparing white precipitate of mercury, by means of solution in spirit of nitre.

Take, of quicksilver, and pure spirit of nitre, each equal quantities: put them into a mattrafs, with a long neck; and place it in a sand heat of digestion: where let it stand, often shaking the ingredients together, till the mercury appear to be perfectly dissolved, or rather converted into a white salt; for this proportion of fluid will not be sufficient to keep dissolved, the salt produced; at least, when not of a boiling heat: let the mattrafs, therefore, be removed to a degree of heat sufficient to make it boil, a
smaller

smaller mattrafs being put with its neck inverted, into that containing the solution ; and there continued till the salt appear to be wholly dissolved ; which, if it cannot be performed without a greater proportion of fluid, must be effected by the addition of a small quantity of hot water ; that must be added, by degrees, till no solid mass appear to be left in the mattrafs. A strong brine must then be made of sea salt, by pouring hot water on common salt, in the proportion of five pints to two pounds ; and when the solution of the sea salt is cold, the solution of the mercury while, yet hot, must be poured into it ; the proportion of brine used, being two pints to every pound of quicksilver contained in the solution : the quicksilver will then be soon precipitated, and subside to the bottom ; leaving the fluid clear above it ; which as soon as it appears so, must be poured off ; and an equal quantity of fresh water, or more, if the vessel will contain it, added to it : this second quantity must, likewise, be poured off, from the precipitate, as before ; not

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suffering

suffering it to stand longer, than till it become clear by the subsiding of the precipitate. The remaining fluid, and sediment, must then be put into the cullender filters, with paper covered with a linnen cloth; and when the fluid is drained off, and the precipitate left of a due consistence, it must be laid out, on a proper board, to dry, in small lumps, in the shade.

Note.

The design of the precaution of making saturated solutions, both of the mercurial and sea salt, is, to prevent the loss, which, otherwise, happens from part of the quicksilver remaining dissolved; as the precipitated matter is, in fact, itself, in a saline state, and quits the fluid, rather from the defect of a sufficient quantity to keep it dissolved, than from its being rendered of an indissoluble nature: and, for the same reason, the water must be sparingly used in washing off the salts; and not suffered to stand long upon the precipitate. The great carefulness, in this point of washing, which the Edinburg college show, when they direct fresh quantities of water to be added, till it come off without any acrimony, is exercised without any adequate object: for as the fluid, after the precipitation, is made, contains nothing but nitre and sea salt, besides the precipitate, there can
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be no acrimony in question, but that, which is in all sea salt, and nitre, in their proper neutral state; and, therefore, none which can give any injurious qualities to the precipitate, even when internally taken.

The white precipitate is very rarely to be found without great adulteration; as few persons take the trouble of preparing it, but those, who make chemical medicines in great quantities. The most usual ingredients, mixed with it, are white lead and starch: the white lead being used, for the sake of its weight, and the starch for its whiteness: and such kind of practices have become so general, with respect to this subject, that I have seen an eminent vender of drugs, and chemical preparations, reject a parcel of genuine white precipitate, on account of its being greatly heavier, than what he had been accustomed to be supplied with; though the weight is an unquestionable mark of its being really unadulterated. The certain means, however, of detecting any such fraud, practised, in the case of the white precipitate, are, however, very easy; of which this method is one.

Method of detecting adulterations of the white precipitate of mercury.

Take any quantity suspected; and put it in a crucible, with a third of its weight of

any fixt alkaline salt: place the crucible, in fire, where the matter in it may be heated red-hot: let it continue there, while any fumes arise: then take it out; and examine if there be any appearance of melted metal at the bottom; if not, put the residuum, or caput mortuum, left in it, into boiling water; observing whether the water dissolve the whole of it or not.

If there be any appearance of melted metal remaining in the crucible, or, if the other matter found in it, do not dissolve in the boiling water, it may be concluded, that the precipitate was adulterated, either with some metal, or earth, in the same proportion: for the mercury being separated, by the action of the alkaline salt, from the acid, would of course be dissipated in fumes; and the acid would combine with the alkaline salt, and form the vitriolated tartar; so that, if the precipitate were genuine, there could be no metal, nor earthy body remaining: and whatever of such kind should appear to be found in the crucible, with the caput mortuum, which ought to be wholly
of

of a saline nature, must necessarily have been mixt with the precipitate in order to its adulteration.

The addition of starch, to the white precipitate, may be perceived by the lightness of the mass; and may be demonstrated, by putting a small quantity of what is suspected, on a red-hot poker, or into a crucible, with another smaller one inverted into it, and heated in the fire; which will reduce the starch to a coal, if there be any; and render it palpably discernible.

Red precipitate of mercury.

Take, of aqua fortis, sixteen ounces, of sea salt, one dram: distill off the spirit so long as any will rise.

In the compound aqua fortis, thus produced, dissolve an equal weight of purified quicksilver; and, being evaporated, calcine them in a sand heat, till the dried mass has acquired a red colour.

Note.

This is according to the process of the college of London; but, on experiment, the method

thod will be found defective in several respects; and whoever, therefore, would manage this preparation advantageously, must pursue better means.

In the first place, aqua fortis, compounded with a small quantity of spirit of salt, is ordered instead of pure spirit of nitre. The aqua fortis itself, which must be understood to be that made according to the process of the college, is a compound, also, of oil of vitriol and spirit of nitre: for, from the proportion of vitriol used in the preparation, if the distillation be made with a strong fire, a considerable quantity of the oil of vitriol will necessarily be raised with the spirit of nitre; so that the menstrum, employed for dissolving the quicksilver, is a mixture of the three acid spirits of vitriol, nitre, and sea salt; which have no joint operation on the quicksilver, but each combining with its proper portion, will produce the respective salt such combination forms. It is said, however, that the addition of the sea salt is necessary to form that sparkling appearance, which is esteemed in the red precipitate: but this can be no way owing to the effect that such salt may have on the quicksilver itself; for, tho' the oil of vitriol in the aqua fortis, or even the spirit of nitre, if there were no oil of vitriol, would let loose the spirit of the sea salt, which, if the quantity of quicksilver added were as much as the whole of the acid could dissolve, would form a proportionable quantity of sublimate, yet the quantity of oil of vitriol,
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and spirit of nitre, being greater than sufficient to dissolve the whole quantity of quicksilver, the spirit of the sea salt would be prevented, by the superior attraction of the others, from combining with any part of the quicksilver ; and would, consequently, be raised in vapour, and dissipated in the evaporation of the solution, previous to the calcination of the precipitate : and were, really, any quantity of sublimate formed, that would likewise be raised in the calcination, and fly off in fumes, without any effect on the remaining matter. If the sea salt were, indeed, added to the aqua fortis, and no subsequent distillation of the acid spirit made, the small quantity of sal mirabile, produced by the combination of the vitriolic acid with the alkaline basis of the sea salt, might add to the sparkling appearance of the red precipitate ; as the salt itself powdered in the state it would be here found, has a sparkling appearance ; but this is wholly put out of question, by the express direction, given in this process, for distilling the aqua fortis, after the addition of the sea salt, though, as I presume, from some mistake. The only effectual difference, therefore, betwixt the use of the pure spirit of nitre, and this compound aqua fortis, must appear to be, that a part of the mercurial salt, formed in order to produce the red precipitate by the subsequent calcination, must be compounded from the vitriolic acid in the aqua fortis, and, consequently, be the same, as that from whence the turpeth mineral is, by a similar calcination, produced ;

duced ; which being only a white mass, unless converted into a yellow one by the addition of water, must weaken the red colour of the precipitate ; and change greatly its medicinal qualities ; and that, not in any certain proportion, but as the vitriolic acid shall happen to abound more or less in the aqua fortis, according to the degree of fire used in the distillation of it, or other attendant circumstances. It is, therefore, much better, with respect to the medicinal intention, to use pure spirit of nitre, in the preparation here advised, from whence one regular effect may be obtained : and, with respect to the beautiful appearance, so necessary to the saleable condition of this medicine, it will be found equally advantageous, when conducted in the manner below directed.

Improved process for making the red precipitate of mercury.

Take, of quicksilver, and pure spirit of nitre, equal quantities : put them into a matraass, with a long neck ; and place them in a digesting heat ; shaking the matraass frequently, till the quicksilver be wholly dissolved, (that is to say, converted wholly into a transparent fluid ; or partly into such fluid, and partly into a mass of white salt) : put this solution, and salt, into a
long

long small cucurbit ; and place it in a sand heat, where the bottom of the cucurbit may receive a considerable heat : fit a proper glass head, and receiver, to the cucurbit ; and distill off all the fluid that will come over : when the fumes appear to rise very sparingly, take off the head of the cucurbit ; and, by some proper instrument, draw out some of the contents, which will now be the red precipitate ; and examine, if, on cooling, it appear of a fine red colour ; in which case, lay a tile on the mouth of the cucurbit, and raise it gradually in the sand, so as to prevent its suffering any longer the action of a strong heat ; but, if, on the examination, it appear of a yellow, or orange colour, and not so crimson as it ought to be, on comparing it with a proper specimen,) which should be always had, in order to the forming a better judgment,) the head should be put again on the cucurbit, but without the trouble of luting, and the heat should be continued again for some time, till, on further examination, by the same means, the precipitate be found to be
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of the proper colour : when, the cucurbit having been immediately raised out of the great heat, and suffered to cool, the contents must be taken out ; and broken into an equal gross powder ; but not levigated, or reduced to a finer state.

Note.

By this method, the red precipitate will not only be made as cheap, and equally beautiful, in its appearance, as with the trouble of the subordinate process for the compound of aqua fortis ; but its medicinal qualities will be always similar and equal, both in the nature and force, of their operation ; which is certainly of great consequence at present, as this preparation is used internally by many, and even given very freely, with respect to the largeness of the dose : whereas, when aqua fortis is employed in the preparation, in the place of spirit of nitre, an uncertain quantity of turpeth mineral will, of course, be produced : and, in many cases, may operate in a manner very contrary to the intention of the medicine.

It is necessary, that pure quicksilver be employed as well for this, as the other precipitates.

The particular appearance of red precipitate, both with regard to its bright red colour, and the sparkling particles, it seems to be composed of, prevent it from being so frequently adulterated, as it otherwise would be : but it is,
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nevertheless, sometimes sophisticated with red lead, finely levigated, and mixed with cinnabar, or vermilion; which, together, imitate the colour nearly enough to deceive any, who have not an exact remembrance of the red precipitate. Where the sparkling appearance, or bright colour, therefore, seem wanting, and there is any reason to suspect a fraud of this kind, a small quantity, of the parcel suspected, may be put into a crucible, with a little charcoal dust: and covered by means of another lesser crucible inverted; and, being exposed to a heat sufficient to fuse lead, and continued so for some time, the red lead, if there be any, will be reduced; and regain its proper metal-line form: and, if another quantity be put on a red-hot poker, the immediate sublimation of the cinnabar, in copious fumes, will readily betray its presence; if the red precipitate in question has been sophisticated with it.

Yellow emetic mercury, or turpeth mineral.

Put any quantity of quicksilver into a glass; and pour on it double its weight of oil of vitriol: heat the mixture, by slow degrees, till it boil; and continue it in that state, till only a white mass be found at the bottom; which, the fire being increased, must be made perfectly dry: this mass,
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on the pouring water on it, will immediately turn intensely yellow ; and fall to powder : let it be ground with this water, for a considerable time, in a glass mortar ; and, after the powder has subsided, the water must be poured off ; and successive quantities added, till it be entirely sweet.

Note.

The proportion of the oil of vitriol to the quicksilver has always been very erroneous, in all the processes given for this preparation. The college of Edinburg direct four to one : and the college of London, in the process here given, though they have ordered only half that quantity, have yet, nevertheless, more than doubled what is really necessary to be used. This will appear evident on the least consideration, that the adding more oil of vitriol to the quicksilver, than can act on it, must be entirely needless : and less than the proportion of acid, contained in an equal quantity of the oil of vitriol, is sufficient to form the quicksilver into a perfect salt ; as we see in the case of spirit of nitre, in the preparation of the red precipitate ; after which neutralization, no further change can be made by any operation of the acid on it. No more oil of vitriol should, therefore, be used than will combine with the quicksilver ; for though, at the present price, the waste is a
matter

matter of no great consequence ; yet the tediousness of bringing over so great a quantity of oil of vitriol, that requires a very strong heat to raise it, and is with difficulty, indeed, brought over at all, in a sand heat, together with the necessity, which the redundant acid, that will remain with the calx, when this quantity is used, produces of washing the turpeth with several fresh quantities of water, to the loss of a considerable part of it, are very strong objections, against the wantonly employing more than the due preparation of the medicine makes requisite.

The pouring successive quantities of water on the calx, is, likewise, both needless, and wasteful : for almost the whole quantity of the turpeth might, in time, be washed away by this means ; the quicksilver, being, in fact, reduced to the state of a salt, though of a kind very difficultly soluble.

The end of this washing cannot, therefore, properly be any other than the freeing the calx from any redundant acid ; which may be, to a certain degree, much better done by employing so great a heat in the calcination, as may drive off all the acid, that is not fixed by the quicksilver ; after which, the edulcoration may be sufficiently perfected by such an ablution, as will make very little waste of the turpeth : the following process will, therefore, afford a greater produce of turpeth equally good : though prepared with less expence, and much less trouble.

More expedite and profitable method of preparing the turpeth mineral.

Take, of purified quicksilver, and oil of vitriol, equal parts : put them into a retort, with a low neck ; and place it in a sand heat : distill off all the fluid, which will come over ; urging it at last with a very strong heat : take the mass, which remains, after the distillation, in the retort, and break it to powder ; water being poured on it ; which will immediately convert it, from a white to a yellow colour : let it be well ground with this water, which must be afterwards, the powder having subsided, poured off from it ; and a fresh quantity supplied ; the same subsequent treatment being repeated : the powder must be then freed, from the remaining fluid, by putting it into a proper filter with paper, and a linnen cloth ; and afterwards dried on a board.

Note.

The quicksilver ought to be proved, before it is used for this purpose ; and, if any adulteration be found, it should be purified by distillation.

lation. It is very rare, that the turpeth is attempted to be adulterated: because the price of it is not great; and no other matter could be commixt with it, which would not deprave the colour, or discover itself by other appearances. The best method, therefore, of guarding against any imposition, with respect to this medicine, is to have a specimen of such as is perfect at hand; and to compare any suspected parcel with it; which, if it differ not in the bright yellow colour, may be with certainty concluded to be unsophisticated.

Precipitate per se.

Let purified quicksilver be placed, in a sand heat, for several months, in a proper glass, with a small hole, by which the air may have access; and let it remain, in that state, till it be calcined into a red powder.

Note.

This will be much shortned by performing it in the glass described p. 49; where, by the greatly increasing the surface of the mercury, and promoting the influx of air by the tubes inserted in the lower part of the glass, the operation will be greatly accelerated: but, in this case, the glass must not be surrounded with sand, but placed in a situation where the bottom of it may be heated to a proper degree,

without any solid medium surrounding it, which is no way necessary.

As the keeping a constant sand heat, for the effecting this process, which requires so great a length of time, would be attended with great expence, and trouble, it is much better to procure the glass to be placed in a proper hole in some of the outward parts of a glass-maker's, or malt-distiller's furnace, where it will undergo a due heat: and by this method, the operation will be equally well performed; and all the expence, and trouble, of keeping a fire, on purpose, intirely saved.

Æthiops mineralis.

Take, of flowers of sulphur, and of purified quicksilver, each equal quantities; grind them well together, in a glass mortar, till they be incorporated into a black powder.

Note.

The most usual sophistication of this medicine is, by increasing the quantity of the sulphur; which may be discovered by revivifying the mercury by distillation; or, with less trouble, by boiling two or three ounces, or any known quantity, of the suspected parcel, in soap lees; by which means, the quicksilver being separated, it may be weighed; and its proportion to the quantity it was extracted from known.

known. This will, likewise, discover if it be adulterated by any other mixture; for, the sulphur being dissolved in the lye, and the quicksilver reduced to its metalline state, the other heterogeneous matter will of course be distinguishable.

There is a method for the preparation of æthiops mineralis sometimes practised, to save the trouble of grinding them together, till they incorporate; which is as follows.

Quicker method of preparing the æthiops mineralis.

Take, of quicksilver, and sulphur, equal parts; melt the sulphur, taking care that it do not take fire: when melted, add to it the quicksilver, very gradually, stirring them well together: and, if the mixture take fire, from their effervescence, extinguish it immediately, by throwing a wet cloth over the vessel: when the mixture is cold, levigate it.

Note.

This is, by some, thought a shorter, and better, method than the other, of mixing the ingredients of the æthiops mineralis: but there is very little, if any, trouble saved by it; and

it is very dubious, whether the qualities of the medicine may not be altered by this method of preparation ; especially, as it is impossible to reduce the mass of the united quicksilver, and sulphur, to so fine a powder, by any mechanical method of levigation, as the other will be, necessarily, from the manner, in which the parts of the sulphur are divided, by the sublimation, in the forming it into the flowers.

Fictitious cinnabar.

Take, of purified quicksilver, twenty five ounces ; of sulphur, nine ounces : melt the sulphur ; and add the quicksilver to it ; and, if the mixture take fire, extinguish it by covering the vessel : afterwards, let the mass be reduced to powder, and sublimed.

Note.

This sublimation should be performed in a coated body of glass, hung in the naked fire : the sufficiency of a sand heat being very precarious.

The quantity of sulphur, here directed, is larger than has been generally prescribed, when this preparation has been intended for medicinal use : but the far greatest part of the fictitious cinnabar, being designed for the purposes of painting, where it is used under the
name

name of vermillion, both the augmentation of the profit, from the low price of the sulphur, and the improvement of the colour, have induced the preparers to enlarge the proportion of sulphur to at least one third.

The flowers of sulphur, though not directed in this process of the college, should always be used: for, if the roll sulphur be substituted, in the place of them, and should happen to be adulterated, as is very frequently the case, with coarse resin, the beauty, at least, of the cinnabar would be vastly impaired.

The manner of sublimation is, likewise, of great consequence, to the fine colour of the cinnabar; the producing which is a profitable secret to those, who manufacture the vermillion: it lies principally in raising the fumes of the cinnabar so quick, that no part may settle in flowers; but the whole form itself according to that specific texture, which appertains to this substance; in which particular, it corresponds with salts, that if condensed in such a degree of heat, as suffers the particles to coalesce as they would in a fluid state, form crystals; but if, in a less, they settle without exerting their specific attraction, and become only that kind of powder we call flowers. The following method may, therefore, be advantageously pursued, where cinnabar is prepared as vermillion; and, for medicinal purposes, its difference, from that of the college prepared according to the process above, will not be very material; as there are no data, from

whence we can draw any conclusions, what proportion of the quicksilver, and sulphur, would produce the most efficacious medicine.

Method of preparing cinnabar, particularly with a view to the forming vermilion of a very beautiful colour.

Take, of quicksilver, eighteen pounds, of flowers of sulphur six pounds : melt the sulphur in an earthen pot ; and pour in the quicksilver, very gradually ; stirring them together with a tobacco-pipe ; and, if, from the effervescence on adding the last quantity of the quicksilver, they take fire, immediately extinguish it by throwing a wet cloth over the vessel : when the mixt mass is cold, powder it ; so that the several parts shall be well mixt together ; but it is not necessary to reduce it by levigation to an impalpable state : having then prepared an oblong glass body, by coating it well with fire lute, over the whole surface of the glass, and working a proper rim of the same round it, so that it may hang in such manner, that one half of it may be exposed to the fire within the cavity of the furnace, let the powdered

I mass

mass be put into it, so as to fill the part, that is within the furnace; and a piece of broken tile be laid over the mouth of the glass: sublime the cinnabar then, with as strong a heat as may be used without blowing the fumes of the cinnabar out of the mouth of the glass; and, if there be any danger, that the sublimed cake should form itself so in the mouth, as to stop up all vent, lift up the tile at proper intervals; and, with the end of a tobacco-pipe, preserve some passage, lest, on too great an augmentation of the heat, the confined vapour should burst the glass: when the sublimation is over, which may be perceived by the abatement of heat in the upper part of the body, discontinue the fire; and, when the matter contained in the glass is cold, take it out; and separate from it, any part, which appears dissimilar to the rest: powder then the perfect part which is designed to be used, as vermilion; and keep what may be necessary for medicinal uses, in lumps of the sublimed cake.

Note.

Note.

The vermilion should be levigated as finely as possible : for nothing contributes more to its beautiful colour, as well as its excellence in other respects, than the fineness of its powder. It is generally levigated by means of a hand mill, where considerable quantities are manufactured ; but it may be rendered more impalpable, by the use of the muller and levigating stone, than any mill can effect.

The cinnabar, designed for medicinal use, should be procured by those, who use it in an unlevigated state ; and powdered by themselves, to prevent the sophistication, by red-lead, so frequently practised, where it is sold in the state of powder. This fraud is greatly pursued by the dealers in vermilion ; as it is difficult to distinguish by the appearance, or immediately even in the use of it, the adulterate from the pure ; but it is very injurious to the qualities of the paint, made of it ; for, whereas the genuine vermilion would retain its beauty a long time ; the red-lead, on the contrary, soon turns black ; and, when mixt with the other, consequently, soon destroys its brightness.

This sophistication may, however, be easily detected by very simple means, in the following way.

Method

Method of detecting the adulteration of cinnabar, or vermilion, by the admixture of red-lead.

Take a small, but known, quantity of the cinnabar, or vermilion, suspected to be adulterated ; and put it into a crucible ; having first mixt with it about the same quantity, in bulk, of charcoal dust : put the crucible in a common fire ; having covered it with another lesser crucible, inverted ; and give a heat sufficient to fuse lead : when the crucible, being taken out of the fire, should be well shaken by striking it against the ground. If the suspected adulteration has been practised, the lead will be found, reduced to its metalline state, in the bottom of the crucible ; and, being weighed, and compared with the quantity of cinnabar put into the crucible, the proportion of the adulteration may be thence certainly known : but, if no lead be found in the crucible, it may be safely inferred, that no red-lead had been commixt with the cinnabar.

Note.

Note.

The adulteration of cinnabar, by red-lead, may be discovered, if in a greater degree, by the comparing the suspected parcel, with a specimen of the pure : for though the red-lead does not greatly take off from the brightness of the colour of the vermilion; yet it gives a tinge of orange colour to it, not found in the genuine; which will, consequently, appear different from the adulterate, by its more crimson hue.

Cinnabar of antimony.

Take, of antimony, one pound, of corrosive sublimate, two pounds: powder them separately; and let them be thoroughly mixed, and distilled, in a sand heat; being contained in a retort, whose neck must be large: sublime what remains, in the retort, in a coated mattrafs, placed in the open fire.

Note.

The proportion of sublimate here directed, in this process, which is that of the college, differs from those prescribed in the former processes: but it is, probably, with a view to the antimonial caustic that is produced along with the cinnabar, they have made this deviation ;

tion ; for the quantity of cinnabar will be diminished, to the loss of the preparer without any demonstrable, or even rationally presumptive improvement of the medicine.

The process is, likewise, contrary to the former practice, divided into two operations ; the first for distilling the butter of antimony, or antimonial caustic, in a retort, with a sand heat ; the other for subliming, in a matrafs, the cinnabar, being the caput mortuum, or recrement remaining after the distillation ; instead of performing the whole together, in a coated retort, in the naked fire. Where large quantities are to be prepared, this is certainly the more expedient method ; for, when both operations are performed in the same vessel, the cinnabar butter, are very apt to be commixt with each other, and the retort extremely liable to be cracked by the augmented heat, required for subliming the cinnabar.

But though the subsequent sublimation of the cinnabar, in a distinct vessel from that in which the butter is distilled, may be considered as an improvement ; yet the choice of a matrafs, as the proper vessel for it, is certainly a great error ; as the round figure of a matrafs, though very suitable to some kind of sublimations in sand-pots, is by no means convenient for such glasses, as are fixed in the cavity of the furnace itself ; the nearness of the uppermost part above the fire to that which must be surrounded by it being so great, that it is impossible to give the due subliming heat to the one, without rendering

rendering the other hotter than the degree proper for condensation; and, therefore, either the heat must be so suppressed, that the operation cannot be duly advanced, or the fumes of the subliming matter would be driven out of the neck of the vessel; or, collecting in it, choak up the vent, and burst the glass. A body, therefore, of oblong form, which admits of a due distance betwixt the upper and lower parts, as well as of the room necessary for the rim of lute, by which it must be hung, is far preferable: but, if the quantity be not great, it is proper to have some kind of dome, or cover, to the furnace, by which the body may be hung; since it would, otherwise, be unavoidable, to use a large body; as no other could be fixed in a common sized furnace: and this would render the sublimed cake of cinnabar so thin, as not to have the salable appearance.

This cover, or dome, for hanging the subliming vessel, may be a flat rim of cast iron laid over the furnace, and contracting the opening into it, to the wideness proper for the purpose, so as to suffer the coated body, to hang upon it, by the rim of lute worked round it for that end.

The trouble and expence of making the cinnabar of antimony from crude antimony, and sublimate, (the butter, or antimonial caustic, the other produce of this operation being seldom called for,) have occasioned the seeking other methods of preparing it; as well as substitutions of other kinds of cinnabar

bar for it: amongst which, the following is the oldest, and has been the most practised.

Common preparation of cinnabar of antimony, without the mercury sublimate.

Take, of crude mercury, thirteen ounces; of flowers of sulphur, five ounces, and of crude antimony, one ounce and a half: mix them well together; and sublime them, in a coated vessel, in a naked fire.

Note.

Though this has been vainly supposed to differ from other fictitious cinnabar, by the addition of the antimony: yet it is in every respect the same; the antimony not being any way analyzed, or yielding any part of its sulphur to the mercury, by this treatment. And, indeed, if the cinnabar be prepared with this proportion of sulphur, it will not have, in the least degree, that appearance, which distinguishes the cinnabar of antimony from common fictitious cinnabar: the first being formed in long needles like shoots, which seem regularly joined to each other, in a parallel direction; but the latter, in short irregular stria, and of a much more compact, and less friable texture.

This irrefemblance may, however, be avoided; and a cinnabar prepared, by better adopting the proportion of the quicksilver and sulphur to this purpose, which will be indistinguishable from the true cinnabar of antimony made with sublimate, according to the above given process; and without the use of any antimony at all; of which, however, a small quantity may be put in to save the honour of those, who are scrupulously nice in the manner of deceiving.

The following is the most expedite method of preparing this kind of cinnabar.

Method of preparing cinnabar exactly resembling the cinnabar of antimony made with sublimate.

Take, of quicksilver, six pounds, of flowers of sulphur, one pound: incorporate the quicksilver with the melted sulphur; and, having pounded the mass, so that the several parts of it may be well mixt together, put it in a coated body, of which it will fill almost half; and sublime it, in the naked fire: taking away, after the sublimation, such parts as have not the proper striated, or needlelike appearance.

Note.

Note.

The particular manner of conducting this process, may be regulated by the directions more particularly given before, in the process for preparing the cinnabar for vermilion.

The cinnabar, prepared from this proportion of quicksilver and sulphur, is, in every respect, similar to that made from the sublimate and crude antimony, and may be substituted for it, without any real injury to the medicinal intention : for, notwithstanding the manner of preparation, and the authority of long usage, there is really nothing more in the cinnabar made from the sublimate and antimony, supposing it intirely freed from the butter, or antimonial caustic, that arises along with it, than in that made from quicksilver and common mineral sulphur : for the sulphur of the antimony, which is the common mineral sulphur, being separated from the reguline part of the antimony, combines with the quicksilver in the same manner, as any other portion of such sulphur would ; and suffers the spirit of salt, which the sublimate contains, to raise with it the reguline part of the antimony ; the quicksilver, which is the other constituent, being left at liberty to combine with the sulphur. Nor is it of any real consequence to add the crude antimony to the quicksilver, and sulphur, used in the process here given, even though the quantity of sulphur be very small ; for

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without

without the medium of the spirit of salt, which is added by using the sublimate, to separate the reguline part from the sulphur, they remain combined ; and passively suffer the cinnabar to be sublimed, and leave them in their intire state ; without undergoing themselves, or producing any change in the cinnabar.

The cinnabar of antimony is subject to the same adulterations as the fictitious cinnabar ; and they may be discovered by the means before directed : but, if it be had unlevigated, and the stria appear like long needles, there can be no room for either suspecting any adulteration, or substitution : unless of fictitious cinnabar, prepared in some manner parallel to that here given for the imitation of cinnabar of antimony ; against which, there can be no guard, as they are, in fact, the same thing in every respect.

Regulus and sulphur auratum of antimony.

Take, of antimony, sixteen ounces, of tartar, one pound, and of nitre, half a pound ; let them be separately powdered, and mixed well together : then let this mixture be put, gradually, into a red-hot crucible, fused with a very strong fire ; and afterwards poured into a proper conic mould.

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The metalline part, commonly called the regulus of antimony, will sink below the scoria ; and must be separated from it.

The scoria must be dissolved in water ; and the solution filtered through paper : after which a precipitation must be made, from it, of the sulphur ; by dropping, into it, spirit of sea salt : and, lastly, the precipitated matter must be freed, from the salts, by washing in water.

Note.

This is according to the college of London ; and, indeed, is the old process given by Lemery ; and, from him, by Quincy. The method is something more expensive than necessary ; because the tartar and nitre might be wholly omitted, if eight or ten ounces of pearl-ashes, or any fixt alkaline salt, were substituted in the place of them, as they act no other way advantageously, with respect to the end of the process, than by producing a fixt alkaline salt ; and, in this case, the regulus would be more ductile ; and, consequently, more easily formed into cups, or any other figured vessel, for making the antimonial wine.

But, as the consumption of this kind of regulus is very small, it is not of great consequence which method is pursued.

But, if the sulphur auratum should be, however, demanded in any larger quantity, the use of the pearl-ashes, instead of the nitre and tartar, would be found much more advantageous ; and may be substituted in the following manner.

Cheap and compendious method of producing copiously the sulphur auratum antimonij.

Take, of antimony, and any fixt alkaline salt, equal parts : powder the antimony ; and, having mixt it thoroughly with the salt, put them into a crucible ; and give them a fusing heat : when they are thoroughly melted, pour the mass into a deep mold greased ; and, when cold, separate the scoria from the reguline part ; and boil it, for some time, in water, to dissolve the salt : filter the solution through paper ; and, afterwards, drop spirit of salt, very gradually, into it, so long as it appears to produce any turbidness, or effervescence ; the sulphur will be by this means precipitated, which must be washed in several successive quantities of water ; and then separated, from the fluid, by means, first of decantation,

tion, when the sediment is perfectly subsided ; and afterwards of draining off the remaining moisture through a filter, in which a linnen cloth is laid over paper : and, being of due consistence, it must be, at last, dried on a board, in the shade.

Note.

This method will produce much greater quantities of the sulphur, than where nitre is used : as a considerable part of what the antimony contains is destroyed in the deflagration ; especially, where tartar is not at all, or only sparingly, used in the deflagration.

At present this improvement is of no great moment, to the practice of commercial chemistry, as the demand for it is small : but when, as may probably happen some time, the secrets of a certain great empiric shall be revealed to the world, and it shall be found, that many of his most boasted cures were owing to this remedy, it will doubtless be brought, for at least some time, into high vogue ; and the demand for it so increased, as may make it well worth while to inquire after the easiest means of producing it.

The regulus, prepared in this manner, will be, perhaps, superior to all others, as well for medicinal, as other purposes : but where regulus of antimony is wanted, for any other than medicinal uses, it is usually prepared with steel : and,

indeed, that kind will equally well answer every intention as a medicine : and is mostly substituted for the other ; from which, it has no essential difference ; it being the same, in effect, whether the redundant sulphur of the antimony be attracted, from the proper metallic part, by means of fixt alkaline salts, or iron.

The common method of preparing the martial regulus, (as it is called,) is as follows.

Martial regulus ; or regulus of antimony prepared with steel.

Take, of small nails, two pounds and a half : put them into a large crucible, placed upon a tile, in a melting, or wind furnace ; let the fire kindle about them gradually, till the nails are ready to melt : then project, by a large spoonful at a time, of antimony, one pound, of nitre, four ounces, and of tartar two ounces, all powdered, and mixed well together. Bury the crucible in charcoal ; and, shutting the door of the furnace, let it stand in the strongest fusion, till the mixture it contains has done sparkling : then take it from the fire ; and pour the matter into an iron mortar, made hot, and previously greased. When the
mass

mass is cold, beat off the scoria from the regulus.

Note.

This is the regulus as commonly used for other than medicinal purposes; but for those, it is generally directed to be converted into the regulus stellatus; which is done, by repeated fusions with additional quantities of nitre.

But where iron is used, the addition of nitre and tartar is needless; the iron being sufficient to attract the redundant sulphur from the reguline part of the antimony: but the scoria formed by the sulphur and iron without salts, being of an hard untractable nature, it is difficult to separate it from the regulus; for which reason, it is proper to add a quantity, equal to half the weight of the iron, of the sal enixum, or caput mortuum, after the distillation of nitre; which, in most laboratories, is otherwise generally thrown away: and this proportion of salt will render it very easy, by soaking in water, to scrape off all the scoria without any loss of the regulus.

The quantity of iron is, likewise, much more than requisite: as an equal weight will be fully sufficient to absorb the redundant sulphur: the college of Edinburg have directed only half the weight: but then they have greatly enlarged the proportion of nitre and tartar; the alkaline salt, formed from which, make up for the deficiency of the iron. This, however,

can scarcely be called the martial regulus, or preparation of the regulus of antimony by steel ; because, if the iron were omitted, the operation would succeed equally well : as appears from their process for the common regulus, in which, the proportion of the nitre and tartar are the same as for this, and no other circumstances different, besides the omission of the iron.

The martial regulus may be, therefore, best prepared by the following method.

More profitable preparation of the regulus of antimony, by means of steel.

Take, of crude antimony, and iron nails, each one pound, of the sal enixum, or caput mortuum, after the distillation of spirit of nitre by Glauber's method, half a pound, of pearl-ashes, or any fixt alkaline salt, two ounces : put the iron nails into a crucible, and place it in a wind furnace ; and, when it is white hot, throw in the antimony and salts powdered together, by a large spoonful at a time ; giving the mixture time to recover its heat betwixt each addition : when the whole is commixt, close the door of the furnace, and continue the

the mixture in a fusing heat, for some minutes ; and then pour it out, into a deep copper mould, a little deviating from the cylindrical form, (that the mass of metal may the more easily be turned out of it), heated, and greased ; and, when it is cold, let the end of it, where the scoria adhere, be soaked, for some time, in water, which will make them crumble off, without a necessity of breaking the cast of the regulus.

Note.

It is by methods similar to this, that regulus of antimony is prepared for the use of the pewterers, by those, who make it their particular business : and it is indifferent, by what means, the common sulphur, contained in the crude antimony, is extracted from it : or whether iron, or the fixt alkaline salt, produced by the addition of nitre and tartar, be the instrument. But where nitre is added to the fused regulus without tartar ; or with a great excess in quantity, as in the preparation of the stellate regulus, as it is called, an essential difference is wrought : for the nitre destroying, or the fixt alkaline salt, produced by it, absorbing, more of the sulphur of the regulus, an approximation is made towards that state, in which antimony is most forcible in its operation

ration on the human constitution; as it is only, by a perfect calcination of the fixed sulphur, the glass of antimony, the most powerful of all the preparations, is formed.

It was from this difference, therefore, that all the old processes direct the continuation of those parts of the operation, which they thought necessary for the producing what is now called the stellated antimony, without distinguishing it by any name from the less calcined martial regulus; but giving this the name of martial to distinguish it from what is made by means of nitre and tartar; which they called the common: and as, therefore, the regulus is undoubtedly of a more powerful operation, as a medicine, in this state, it ought to be reduced to it; where the intention of the prescriber is to have it so. But as that part of the common processes, which respects the converting the martial regulus, produced as above, into the stellated kind, are unnecessarily complex and laborious, I will, after giving them, as they are generally directed, shew the most simple and expedite method of preparing it.

Preparation of the stellated regulus of antimony, from the martial regulus.

Take, of the martial regulus, freed from the scoria, one pound: put it, in a crucible,
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into a wind furnace ; and, being in fusion, add to it two ounces of nitre powdered : let it continue in the fire, till all appearance of the deflagration be over ; and then cast it into a mould, as before : let this operation be repeated, three or four times ; the same quantity of nitre being used ; and care being taken, that the regulus be in perfect fusion, the last time the nitre is added : the scoria being then taken off, after the regulus is cold, the appearance of a star will be found on the surface.

N. B. In order to have the star shew itself more favourably, the regulus may be cast, the last time, into the bottom of a mortar, previously greased, instead of the deep mould.

Note.

The Edinburg college order equal parts of nitre, and tartar, to be used ; and a great proportion to be employed ; but this can answer no end ; for the greatest part of the nitre, deflagrating with the sulphur, in the tartar, has no action on the antimony ; producing only a proportionable quantity of fixt alkaline salt, which is of no effect here : the end of this repeated fusion, with nitre, being only to destroy

stroy a part of the sulphur of the antimony; by which means the stellated appearance is produced.

The repeated operations of fusion, and deflagration, are unnecessary; for, with less nitre, and an addition of some fixt alkaline salt, to assist in absorbing the remains of the refluxing sulphur, one fusion may be made to serve the end equally well, by the following method.

More compendious and expedite method of preparing the stellated regulus of antimony, from the martial regulus.

Take, of the martial regulus, freed from the scoria, one pound: being put into a crucible, set it in a wind furnace; and, when thoroughly fused, throw into it, by a spoonful at a time, of nitre, two ounces, and of any fixt alkaline, three ounces; stirring the mixture well together, with the end of a tobacco-pipe, betwixt each addition of the nitre and alkaline salt, as well as when the whole is thrown in. Let the matter remain, for some time after, in strong fusion; and then cast it into an iron mortar greased; and, when cold, take off the scoria.

Note.

By this means, the stellated regulus may be produced with greatly less trouble and expence: for the quantity of nitre used will be sufficient to destroy the due proportion of the proper sulphur of the regulus: and the alkaline salt will absorb any remainder of the common sulphur: and if the stellated appearance should not be found, which will sometimes be the case, in every method of preparation, it is not in the least material, with respect to the medicinal efficacy of the regulus.

Though custom has established the use of nitre, in this further preparation of the regulus, after the first precipitation of it from the sulphur in the crude antimony: yet, the fluxing it twice with fixt alkaline salts, mixed with a little crude tartar, is much the best way of further purifying the regulus; and it has this further good effect, where it is wanted for making the antimonial wine, that the texture is not rendered so unfit for that use; as it remains ductile; and may be easily cast into any such kind of form.

Crocus antimonij, commonly called crocus metallorum.

Take, of antimony, and nitre, an equal weight: being separately powdered, let them
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be well mixed together ; and put, by degrees, into a red hot crucible, where they may be fused : having poured them out of the crucible, let the scoria be taken off from them. The mass will then appear of various colours ; and the longer it has continued fused in the fire, the more it will approach to yellow.

Note.

This is the *crocus antimonij* of the college, and of the old practice : but the modern preparers of medicine have introduced another kind, more profitably prepared by the using a less proportion of nitre ; by which, not only a saving is made, in the quantity of the dearest ingredient ; but less of the sulphur of the antimony being destroyed, the produce is necessarily greater. The small consumption, made of this preparation in medicine, would not, perhaps, have afforded any temptation to this practice : but the *crocus metallorum*, being one of the capital articles of the farriers, who use every thing in great quantities, the demand for it has been considerable enough to induce the great dealers, to think of obtaining this, as well as other articles, at the cheapest rate they could.

When the *crocus metallorum* is prepared in great quantities, there is, likewise, a much less troublesome and expensive method of performing

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ing the deflagration, than by the use of any furnace : which is by producing the necessary effect, with respect to the fusion, by the heat generated by the matter itself, in consequence of the explosive action of the nitre, and sulphur contained in the crude antimony ; and this explosive action may be rendered more efficacious, to this end, by the addition of a small quantity of sea salt to the other ingredients. The best method of conducting this operation, and the proportion of nitre generally made use of, are as follows.

*Method of preparing the common crocus metal-
lorum, without using any furnace, or em-
ploying any exterior heat.*

Take, of crude antimony, sixteen pounds, of nitre, fourteen pounds, of sea salt one pound : powder the antimony and nitre separately ; and then mix them thoroughly together, adding the common salt : put this mixture into an iron pot, such as is commonly used for boiling flesh, of a proper size ; and cover the pot with a flat plate of iron, or large stone ; leaving, nevertheless, some vent for the vapour to transpire : set the pot in some open place in the air ; and set fire to the mixture contained in it, by

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means

means of an iron rod, or small end of a tobacco pipe heated, and thrust into it ; and let it continue to burn, till the fire extinguishes of itself : when the eruption of the fumes is so abated, that it may be proper to approach the pot, strike it several times on different sides, that the concussion may make the melted metallic part separate, by its weight, from the scoria : and then suffer it to stand till it be cold : the matter being taken out of the pot, the scoria must be separated from the liver coloured mass, which is the *crocus metallorum*.

Note.

This is the common *crocus metallorum*, which is usually found in the shops : it may be distinguished from that, made according to the regular processes, with equal parts of nitre and antimony, by its being less yellow ; and having a more equal and liver like appearance. It is esteemed less powerful in its operation, as a medicine, on account of the sulphurs not being diminished in so great a proportion in it, as in the other ; and probably with reason : but, as there is a certain limitation, with regard to this circumstance, since the destroying too much of the sulphur will weaken the medicinal operation, as well as the leaving too much

much undestroyed, it is not easy to determine, where the exact degree lies: though the fusion of equal parts of the crude antimony, and nitre, is said to be the proportion most likely to produce it.

Diaphoretic antimony.

Let powdered antimony be thoroughly mixed with three times its weight of nitre; and, gradually, put into a crucible just beginning to glow: then, the mixture being taken from the fire, let it be purified by washing in water, as well from the salts, as from the grosser parts less perfectly calcined.

Note.

This preparation ought to be made with care: for, if the whole of the antimony be not reduced to calx, extremely active qualities will be found in it; and produce very unlooked for, and troublesome, effects, in those to whom it is given.

The most material object of care in the preparation, should be the powdering finely, and mixing thoroughly, the ingredients: for, if that be done, and the matter be well stirred with the small end of a tobacco-pipe, the calcination can hardly fail to be perfect; but, if, nevertheless, there appear any parts, that
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will not soften on their maceration in boiling water, they should be separated ; and, being well powdered, may be added to the next quantity of materials used for the same preparation.

The quickest method to free the calx, from the mass of salts it is commixt with, is, after cleansing the outward part of the crucible, to break it ; and put the whole into boiling water, and continue it there, till all the calcined matter will easily separate, from the crucible by a knife, or spatula, without scraping : and, when the sediment has subsided perfectly, the parts of the broken crucible being previously taken out, the water should be poured off ; and fresh quantities added, two or three times : after which, to have the medicine in the greatest perfection, the fine powder should be separated by washing over, according to the methods described p. 62.

This medicine should never be taken from the hands of any, in whom an absolute confidence cannot be placed : for, besides the danger that attends the giving such as is unduly prepared, it is liable to be adulterated by any cretaceous, or other similar matter, without any means of detecting certainly the fraud. The most probable method of perceiving such a sophistication is, by pouring spirit of salt or nitre on the powder, which will produce an effervescence, if chalk, white lead, or many other substances likely to be used for this sophistication, have been commixt with the calx of the antimony ;

antimony: and, by this means, there is a great chance of discovering the adulteration, as the acid spirits have no effect on the calx itself: but there are other substances which may be used, that are intirely neutral with regard to all acids: and, therefore, though this experiment may be conclusive, in many cases, that there is an adulteration; yet it is not demonstrative, that none has been practised.

Bezoar mineral.

Take, of the butter of antimony, three ounces: drop upon it, slowly, the same quantity of spirit of nitre: put the matter in a retort or small body, into a sand heat; and draw off the spirit: to the remaining dry matter, found in the bottom of the retort, or body, add two ounces more of the spirit of nitre; distilling off again, all that will rise, as before: repeat the same treatment three times; and then calcine the white powder, in a crucible, for an hour; using an intense heat: and edulcorate the calx by washing with water.

Note.

The college of Edinburg, according to Lemery and Thebaut, use only as much spirit

of nitre, as will effervesce with the butter of antimony, and there is no more necessary.

They, also, direct the fire to be continued for only half an hour, and to be intense in the calcination ; omitting, likewise, the edulcoration by washing ; which is, indeed, rendered needless, if the fire be intense ; as all saline parts will be intirely expelled by it.

As this is nothing but a calx of antimony produced by the destruction of the sulphur, by means of the nitrous spirit, the far greatest part of the process is of no consequence ; and the repetition of the addition, and separation of so many successive quantities of spirit of nitre, is intirely needless. The following process has, therefore, been given as preferable to the common ones, on account of shortning the preparation, by leaving out the superfluous parts of it.

More expeditious method of preparing the bezoar mineral.

Take any quantity of butter of antimony ; and drop it gradually into three times its weight of spirit of nitre : put it into a small glass body : fit on a head and draw off the spirit in a sand-heat : the remaining dry matter must, then, be put into a crucible ; and calcined with a very strong fire.

Note.

Note.

This is a much quicker way of performing the process; but the quantity of spirit of nitre is far too large, and, if we take the liberty of amending the process in one point, by reasoning on principles, we should do it in all. If we, therefore, consider the nature of the two substances, we shall see, that no more spirit of nitre can be of any consequence, in the operation, than so much as will combine with the regulus contained in the butter of antimony: for, after the regulus and spirit are combined in a certain proportion, the compound becomes neutral to any further quantities of either of its two elements; and, whatever spirit of nitre, beyond the due proportion, is added, remains commixt with it, in a passive state, till brought off in the distillation, without having produced any effect on the matter left behind. The true proportion, therefore, of the spirit of nitre, is so much as will produce any effervescence on being dropt upon the butter; which should be carefully observed in the mixing them.

But there is yet another circumstance of needless expence, in all the processes for this preparation; which is the use of the butter of antimony, instead of the regulus; as will obviously appear, when we consider, of what elements the butter of antimony consists; and how the spirit of nitre acts on it to produce

the bezoar mineral. When the sublimate and antimony are commixt together, and heated, in order to form the butter, the spirit of salt, one of the two constituents of the sublimate, attracted more powerfully by the reguline part of the antimony, than by the mercury, the other constituent leaves it, and combines with the reguline part of the antimony ; which is at the same time, by the superior attraction of the mercury, separated from the common sulphur joined with it, in constituting the crude antimony ; and the mercury, and common sulphur, being thus freed from their former attractives, combine and form the cinnabar, as the spirit of salt and regulus form the butter of antimony ; which being more volatile, or rather less fixed, than the cinnabar, rises with less heat ; and is, by that means, separated from it. As the butter of antimony is, therefore, a compound of regulus of antimony and spirit of salt ; the spirit of nitre being added, which is of superior attraction, dispossesses the spirit of salt of the regulus ; and combines itself with it ; and the spirit of salt, together with any redundant quantity of the spirit of nitre, is brought over in the distillation : leaving the regulus of antimony, and that due proportion of spirit, which, by its combination, it can fix. This being afterwards exposed to the heat sufficient for the deflagration of nitre : the spirit of nitre, combined with the regulus of antimony, deflagrates with it ; and destroys the sulphur, till the regulus be reduced to a calx ; in the same manner,

manner, as if crude nitre had been used instead of the spirit.

It being evident, therefore, that, when the spirit of salt is distilled off in this process, nothing remains but regulus of antimony and spirit of nitre ; it results, that the regulus itself, as it would equally well combine with the spirit of nitre, would be effectually the same as the butter ; and that the preparation might, therefore, be made much cheaper from the regulus, and spirit of nitre than by the more complex process, where the butter is to be previously prepared. When, therefore, this medicament is demanded, it may be prepared in the genuine manner by this cheap and easy method.

A cheap and easy method of preparing genuinely the bezoar mineral.

Take any quantity of the regulus of antimony prepared by any process ; and dissolve it in spirit of nitre : evaporate the solution to dryness ; and put the remaining matter, in a crucible, and calcine it, in a very strong fire, for half an hour, or more, according to the quantity to be calcined.

Note.

By this means, any quantity of the Bezoar mineral, exactly the same with that produced by the most elaborate process, may be very soon

made. But as this is not known to those, of whom it is demanded to prepare, or procure this medicine in the wholesale concerns, they most frequently substitute the diaphoretic antimony for it; and if, indeed, they commit no greater fraud than this substitution, provided the diaphoretic antimony be carefully prepared, and well washed, they may be very well excused: for, undoubtedly, there is no difference betwixt the one and the other; as neither are any thing but the perfect calx of antimony; that is, the earth, which is the basis of that semimetal, wholly deprived of the sulphur by deflagration with nitre: in which operation, it is indifferent, whether the crude nitre, as in the diaphoretic antimony, or the spirit, as in the bezoar mineral, be employed.

Æthiops antimonialis.

Flux equal quantities of antimony, and sea salt, together, in a crucible, for an hour: then let the matter cool: break the crucible; and separate the scoria: afterwards rub the regulus, thus obtained, with an equal quantity of quicksilver, till they be incorporated.

Note.

This was a secret, by which, at one time, the greatest wonders in medicine were pretended to be done. It has been, since, laid open to
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the public ; and recommended, as a preparation of the highest importance : but, I believe, on examination, it will be found to have no further efficacy in it, than what belongs to the *æthiops mineralis*, prepared from common sulphur. For it may be much doubted, notwithstanding the antimony is here after the fluxing with salt, called by the name of *regulus*, whether any change be at all made in it by that operation ; and, whether, consequently, the crude antimony, used without any such previous preparation, may not be equally well used for this purpose : indeed, if there is a great ground of presumption, that the antimony really undergoes any alteration, by fluxing it thus, it must render the medicine very exceptionable ; as in all approaches towards the reguline state, the antimony acquires such active powers, that scarcely any caution in the administering it, is sufficient to countervail the hazard of its violent operation.

Kermes mineral, or poudre des chartreux.

Take, of antimony, four pounds, of solution of fixt nitre per deliquium, one pound, of rain water, three pounds : boil them two hours ; and then filter the boiling decoction, through paper : let it then stand, at rest, twenty four hours ; and it will let fall a yellowish or saffron coloured powder, the
fluid

fluid becoming clear. This fluid, being then poured off by inclination, the powder must be washed, by repeated affusions of warm water ; and, four ounces of spirit of wine being burnt upon it, afterwards dried, and kept for use.

Note.

The antimony ought to be extremely well powdered for this preparation ; as the produce will greatly depend upon the fineness of it.

The use of fixt nitre, preferably to any other pure fixt alkaline salt, is without any reason : and soap lees will facilitate the extraction of the sulphur from the antimony more than a meer solution of fixt alkaline salt.

The burning spirit of wine upon the sulphur, thus extracted, is of no effect : for tho' it was ignorantly practised, as the means ofedulcorating most of the antimonial and mercurial preparations, by the former chemists ; yet, whoever considers, that it is only the vapour of spirit of wine that burns, and that the body of it, which is commixt with the kermes mineral, or any other matter, under operation, is only slightly heated, must be sensible of the absurdity of it.

The same solution of alkaline salts, which was at first used, may, after the sulphur has precipitated from it, on its growing cold, be equally well used again as any fresh quantity ;
for

for it is only through the diminution of the power of the menstruum, by the abatement of the heat, that the precipitation is made: and it will, therefore, dissolve, and take up, the same quantity again, when heated to the same degree; and may serve any repeated number of times, if water be added, to allow for the evaporation, and maintain the proper quantity of fluid.

The solution of salt should, likewise, be poured back again, on the same quantity of antimony, and the boiling, and other subsequent treatment renewed; for it will be found to yield a considerable quantity of the sulphur, notwithstanding the first taken from it: and this may be with advantage even the third time.

The most profitable manner, therefore, of preparing the kermes mineral, will be found to be the following.

Most profitable manner of preparing the kermes mineral.

Take, of antimony, four pounds; and, having reduced it to a fine powder, put it into a solution of one pound of any fixt alkaline salt, dissolved in three pints of water; or into three pints of soap lees; boil the mixture half an hour; and then filter the solution through paper, by means of two or
three

three small earthen cullenders ; that it may not grow cold before it run through : let the filtered solution stand for twenty four hours ; and, then, pour off the clear fluid, from the sediment ; and, putting it to the same powdered antimony it was before boiled with, repeat the former treatment ; and do the same a third time, if the quantity of sulphur, obtained the second, give encouragement for it : the whole quantity of sulphur, being, then, put together, the fluid must be drained off from it, in a filter ; a linnen cloth being put over the paper : and the sulphur must be afterwards dried, on a chalk-stone, in the shade.

The solution of fixt alkaline salt, or the soap lees, which ever were used, may be kept to be employed for the same purpose, another time ; or a further precipitation may be made from it, of the sulphur, by dropping spirit of salt into it, so long as any turbidness, or effervescence shall appear : but, if the repeating the boiling and precipitation be neglected, according to the first process : more than half the kermes mineral,

neral, that may be produced, would be lost.

Note.

By these means, the kermes mineral may be prepared very easily in any quantity : and, as it is, in fact, the same with the sulphur auratum antimonij, they may be promiscuously used ; or rather this method of making the sulphur auratum may be substituted for the other ; as the antimony, after the extraction of the sulphur, in this manner, will equally well, or even better, serve for the making the martial regulus, than while it is in its more crude state.

Fever powder.

Take crude antimony and calcine it with animal oil for two hours ; then put it into nitre, melted in a crucible ; and let it continue there for some time ; and afterwards take out the matter, and wash the salts from it, and dry it.

Take, also, quicksilver : distill it three times, from crude antimony : then dissolve it in spirit of nitre ; and, having evaporated the fluid, calcine the dry mass, in a crucible, till it turn yellow.

Note.

Note.

This is the process for the famous fever powder, as given by the pretended inventor.

The calcination of the antimony, with animal oil, is not of the least consequence to the preparation; for, so long as the antimony is commixt with any inflammable substance, its own calcination will be prevented: and, indeed, whatever change might have been produced in it, by any more efficacious operation, it would have been intirely frustrated again by the deflagration with nitre; which in all cases brings the antimony to a perfect calx, where nothing remains, but that pure simple earth, which is the basis of this semimetal; and does not appear to have the least operation on the human body, nor can ever suffer any change in its nature while pure.

The absurdity of distilling the quicksilver from antimony is equally great: for no analysis of the antimony can be made by means of the addition of quicksilver alone; and, therefore, nothing can be imparted to the quicksilver from it; nor any other effects produced, than what the distillation alone may cause.

If we take away these inefficacious parts of the process, and examine the other operations, we shall see, that the antimony is converted into the state, where it is called the diaphoretic; and by the same direct means; and the quicksilver, into the red precipitate, imperfectly calcined: which two preparations, consequent-

ly,

ly, compose this boasted remedy. In what proportion, these are commixt, to form the powder, has not been hitherto revealed by the preparer of it; nor, perhaps, absolutely settled in his own practice; but, from the manner of operation, one may well presume, that the mercurial part is small, compared to the antimonial; as, otherwise, more frequent evacuations, or other sensible effects, would occur on its being taken.

Preparation of the Greek water (for the solution of silver, for the converting red, or light coloured hair, into a deep brown.)

Take any quantity of silver filings, and dissolve them in spirit of nitre, proved or purified according to the directions given p. 174; the spirit of nitre, and the silver, being put in a matraass, must be placed, first, in a gentle sand-heat, and afterwards removed where the fluid may be made to boil for a short time: being taken out of the sand-heat while yet hot, add as much water as may have evaporated during the boiling; and, when the solution is grown cold, decant off the clear fluid from the sediment, if there be any, and the undissolved part of the silver filings; which may be dissolved, likewise,

likewise, by adding more spirit of nitre, and repeating the same treatment.

Note.

The solution of silver, thus obtained, is the Greek water, used for turning red, or light coloured hair to brown. Its efficacy may be greatly improved by washing the hair, before the application of the water, with common water, in which some salt of tartar, or any other fixt salt has been dissolved; the proportion may be an ounce and half of the salt of tartar, to a pint of the water.

Lunar caustic.

Dissolve pure silver, in about twice its weight of aqua fortis, in a sand-heat: then, the heat being increased, evaporate to dryness: afterwards melt the matter, in a crucible, that it may be poured into proper molds; carefully avoiding too great heat, lest it grow thick, beyond the just degree.

Note.

The college of London, in this process, have done very improperly, in directing aqua fortis instead of spirit of nitre: for the aqua fortis, containing a proportion of oil of vitriol, will
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fail

fail to make a perfect solution of the silver; of which a part, therefore, will be corroded only.

The college of Edinburg have avoided this mistake; but have fallen into a greater, in ordering the fusion to be continued, so long as the matter shall emit any fumes: by which circumstance, they destroy, in a great degree, the efficacy of this medicament: for its only use, being, as a caustic, and its escharotic quality, depending on the concentrated acid of the spirit of nitre, if that acid be thus expelled, a proportionable diminution of its strength must, consequently, accrue. The manner of preparing the lunar caustic, should be, therefore, as follows.

Best method of preparing the lunar caustic.

Take, of silver filings, any quantity: put them, in a small glass body, with three times their weight of spirit of nitre, purified according to the directions given p. 174: let the body remain without heat, till the spirit of nitre appear no longer to act on the silver; and then place it in a moderate heat, till all the silver be dissolved: after which, first evaporate away the moisture, and then put the dry mass into a crucible; and give it a heat just sufficient, to make it run into

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fusion:

fusion: as soon as it is melted, pour the matter into proper formed iron molds, slightly greased.

Salt of steel.

Take, of strong spirit, or oil of vitriol, ten ounces, of steel filings, four ounces, of water, two pints: mix them; and, the effervescence being over, let the mixture stand, for some time, in hot sand: then pour off the fluid; and filter it through paper; and, after the necessary evaporation, set it to chrySTALLIZE.

Note.

This process of the college is at present seldom observed: for, as this is only an artificial preparation of green vitriol, exactly the same with the natural, the latter is substituted in the place of it; but should be first purified, and treated in the following manner.

Method of converting the common green vitriol into salt of steel, equally good with that prepared by the regular process.

Take, of common green vitriol, any quantity: dissolve it in four times its weight
of

of boiling water ; filter the solution, thro' paper ; and add, to it, oil of vitriol, in the proportion of two drams to every ounce : let it then stand to chrySTALLIZE ; and, when the chrySTALS are formed, take them out, and dry them, in the shade.

Note.

This will equal, in all respects, the salt of steel prepared by any other process : as the additional oil of vitriol will prevent its growing turbid, and brown, by keeping ; and it may, therefore, be allowably substituted for the kind regularly prepared.

Ens veneris, or flowers of steel.

Take, of washed colcothar of green vitriol, or of steel filings, one pound, of sal ammoniacum, two pounds : mix, and sublime them, in a retort ; and re-commix what remains in the bottom of the retort with the flowers, by pounding them together : repeat the sublimation, till the flowers acquire a beautiful yellow colour : to what remains after the last sublimation, half a pound of sal ammoniacum may be added ; and the

mixture sublimed as the other ; and this method may be repeated, as long as the flowers can be obtained of a good colour.

Note.

A difficulty seems to be supposed, in this process of the college of London, of obtaining good coloured flowers at the first sublimation : but it is very easy to do it, if proper methods be pursued ; and with a much less quantity of steel, or colcothar, than is here prescribed ; tho' the cheapness of those ingredients renders it, indeed, a matter of indifference, what quantity is used. But the college have been extremely careful to make up for the redundance, at first used, by directing, that subsequent sublimations to produce half a pound, or less, of the flowers, each time, should be made ; that none of the colcothar, or filings, may be wasted ; not considering, that every such operation would cost, besides the trouble, twenty times as much, as the value of the filings, or colcothar, saved.

The college of Edinburg make the ens veneris, and flowers of steel, to be different preparations ; and direct the colcothar of blue vitriol to be used for the first : but where yellow flowers can be prepared from the blue vitriol, (for it cannot be done with all parcels of it,) it must undoubtedly be from the iron contained in it ; and they are, therefore, the same as those prepared from green vitriol, or
crude

crude iron : for which reason, wherever ens veneris is ordered, the flowers of steel, prepared as above, is the kind supplied : and they may be obtained perfect, with greater certainty, by one sublimation, if the following method be used, than the college seem to think practicable, by their advising repeated sublimations for raising a proper colour.

Improved method of making the ens veneris, or flowers of steel.

Take, of green vitriol, one pound : dissolve it in two quarts of warm water ; and precipitate the other from it, by adding to this solution, half a pound of pearl-ashes, dissolved in water : pour off the fluid, when the sediment has subsided ; and add fresh quantities of water, once or twice, to wash the salts from the precipitated powder ; which must afterwards have the remaining fluid drained from it in a filter ; and then be dried.

Let six pounds of sal ammoniacum be then powdered ; the foul parts being scraped off, or picked out ; and afterwards well mixed with the oker, or precipitated iron, prepared as above : put them into a retort,

with a very wide short neck ; and add, to them, two ounces of spirit of salt : fit on a very large receiver ; and sublime the flowers ; gradually suppressing the fire, when nearly the whole is raised. If the neck appear to be choaked by the flowers, as must be concluded from the receiver's seeming unduly cold, the receiver must be taken off ; and a passage procured, by opening a way, thro' the flowers in the neck, by a stick.

Note.

The precipitated oker of the vitriol may be prepared in a larger quantity ; and kept ready for this use : and, if that be done, flowers of steel may, by this method, be prepared, with great certainty ; and very little trouble, of the most full and bright yellow colour ; if the fire be not too long continued : and what remains in the retort, or is found discoloured in the neck, may be used for making the volatile spirit of sal ammoniacum ; for which purpose, it will be no way damaged by the treatment of it in this process : or this caput mortuum, and other foul parts, may be exposed to the air to deliquesce, as the London college advise, in order to make the deliquated steel, which is the fluid that will run from it.

It is not an easy matter to adulterate the flowers of steel without destroying the bright colour :

colour : for there is no substance of the same tint, that would not be equally dear : and if cerufs calcined yellow, or yellow oker, be used, they will greatly diminish the vividness of the colour ; so that, if any so sophisticated be compared with a specimen of such as is perfectly good, the difference will be easily perceived. But a more certain proof of any such adulteration may be quickly made, by putting the flowers into a crucible, and giving a subliming heat ; which will dissipate them, leaving the cerufs, oker, or any such matter, alone in the crucible.

Aurum mosaicum.

Take, of tin, one pound, of flowers of sulphur, seven ounces, of sal ammoniacum, and of purified quicksilver, each half a pound : melt the tin ; and add the quicksilver to it : when the mixture is become cold, powder it ; and mix it, intimately, with the sal ammoniacum, and sulphur : then sublime them in a matrafs : the aurum mosaicum will be found under the sublimed mass, with some dross, at the bottom of the matrafs.

Note.

The proportion of quicksilver, and sal ammoniacum also, are in this process of the college,

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less,

less, by one half, than in those of the Edinburg pharmacopeia, and other books: but, being sufficient to answer the end, this diminution is a real improvement of the preparation; as considerably lessening the expence.

The conduct of this process is somewhat critical; for it very often miscarries; at least, with respect to the quantity of the perfect produce: as, frequently, only a small part of the cake is found of the due colour and brightness.

In order, therefore, to avoid the causes of this failure, it is best to scrape off, and pick out all foul parts of the sal ammoniacum; and to take care, that the tin, and quicksilver, particularly the latter, be not adulterated with lead.

The calcination is best performed in a coated glass body, in the naked fire: for there is no certainty, in a sand heat, of raising the cinabar formed by the quicksilver, intirely from the tin, without a longer continuance of the heat, than is consistent with the success of the operation, in the main point. The coated body should be of a very long form; and little more of it should be exposed to the heat, in the cavity of the furnace, than the part containing the materials. By having a great part of the body out of the heat, the whole of the sal ammoniacum, and quicksilver, may be preserved; as the sal ammoniacum will be collected with part of the sulphur near the top of it, and the quicksilver with the other part of the sulphur, combined in the form of cinabar, nearer to where it is exposed to the fire:

the fal ammoniacum, thus saved, may be used for making the volatile spirit ; for which purpose, the sulphur commixt with it will no way injure it : and the quicksilver converted into cinnabar may be, with any other quantities of foul cinnabar, or calomel, revived by distillation with quick-lime and pearl-ashes ; and, by this means, the principal expence in making the aurum mosaicum re-imburfed.

Flowers of bismuth.

Take any quantity of bismuth, or tin glass : reduce it to a fine powder ; and mix it thoroughly with double its weight of nitre powdered also : put the mixture, by half a spoonful at a time, into an earthen body perforated in the side and furnished with allodials, when the body is red-hot : the operation being over, take off the allodials ; and collect the flowers ; which will be found in them, by sweeping them out with a feather.

Note.

This is the best process, which has been hitherto given, for the flowers of bismuth ; and is much preferable to Lemery's method of using a previous calcination, like that of lead,
and

and subliming the flowers with sal ammoniacum instead of nitre. This may be yet, however, rendered more safe, and easy; if the earthen vessel, instead of the form of a body or cucurbit, be made in that of a retort, and tubulated in the bend of the neck, directly over the center of the bottom. The tube should be about an inch and a half high, and of about an inch diameter; and through the orifice which this tube affords, the matter may be much better thrown in, out of a proper spoon, than through the hole in the side, as directed in the above process; that cannot be closed by any convenient means; but will suffer the fumes of the bismuth to break out: which must be avoided, both on account of the loss of the flowers, and the nuisance it gives to the operator. The tube, in the earthen retort, should have an earthen stopper made along with it; which should be put into the hole, as soon as possible, after the matter is thrown in. The neck of the earthen retort should be three inches wide in the narrowest part: instead of the allodials, a large receiver should be used; which will answer the end better, and with much less trouble: in this receiver should be made a small hole, for a vent to the air generated in the explosion of the nitre with the sulphur of the bismuth; for otherwise the receiver will be very liable to be thrown off from the neck: nor should the juncture of the receiver with the retort be made too close or firm with lute for the same reason.

It is proper to put about an inch height of sand, in the earthen body, or retort ; in order to prevent the matter falling on the heated bottom of the vessel, and causing it to crack : which will be generally the consequence, if this precaution be not used.

The flowers of bismuth have, at present, no place in medicine ; but they are greatly used as a dry cosmetic, or rather fucus ; giving a fairness, and clear appearance, to the skin, when rubbed on it. It is the general practice of the ladies, in Spain, and Portugal, to employ this substance, as a dry paint on their faces and neck ; and a person in London, who prepared it to be sent there is supposed to have got some thousand pounds by the concern : it is now, also, coming into frequent use here, in the same way ; and will probably be much more generally introduced than at present. As, therefore, the preparation called the magistery of bismuth will answer the same purpose ; and may be prepared with much less trouble, I will subjoin the best manner of preparing that also.

Magistery of bismuth.

Take four pounds of pure spirit of nitric ; put it into a mattrafs ; and add, to it, as much bismuth powdered, as the spirit will dissolve ; which will be, according to its strength,

strength, about eight or ten ounces ; precipitate, then, the bismuth from the solution, by putting to it, gradually, four pounds of pearl-ashes, dissolved in three quarts of water, and filtered through paper : when the precipitated powder has subsided, pour off the clear water ; and add several successive quantities of fresh, to wash away all the salts : the powder must then be freed from the remainder of the fluid, by draining through a filter of paper, with a linnen cloth laid over it : and afterwards dried on a chalk-stone in the shade.

Note.

This precipitation has been ordered to be made with sea salt, instead of fixt alkaline salt : but that is by no means a proper, (though cheaper) method, where the magistery is intended to be used as a cosmetic : for, in that case, the acid, remaining conjoined with the bismuth, would render it much too acrid for the skin : nor can it then be strictly deemed a magistery ; which supposes the precipitation to be made by separating the acid dissolvent. But when it is prepared as above, if the salts be entirely washed out, it is as gentle as the flowers made by the above process ; and may be substituted for them, for this purpose of a fucus,

cus, though it is not absolutely the same thing : this being in fact the bismuth itself, unchanged any other way, than by reducing it to the most impalpable powder ; and the flowers of the bismuth reduced to a calx, containing only that earth, which is the basis of this semimetal ; the sulphur being destroyed by the deflagration with the nitre.

The flowers, or magistery of bismuth, are very liable to be adulterated by chalk, lime, or white lead : all which render it injurious, when used constantly as a dry fucus : and it is very difficult to furnish a simple method of detecting the abuse. If, however, the flowers appear lighter than a proper specimen, they may be, with certainty, concluded to be adulterated with chalk, or some calcarious earth : and if it be suspected, they are sophisticated even where of due weight, the putting some of the flowers into a crucible, with the same bulk of charcoal dust thoroughly mixt with them, will shew, if white lead, or calcined tin, be commixed with them, by reducing those metals to their metallic state ; in which they will be found in the bottom of the crucible. But this trial will not avail in the case of the magistery ; for the bismuth, not having been analyzed in the preparation, will itself be fused ; and combine with the lead, or tin, in one equal metallic body.

Distilled

Distilled verdigrise ; properly, chrystals of verdigrise.

Take, of the best verdigrise, four ounces, and of distilled vinegar, one quart : the verdigrise being well powdered, put them together into a mattrafs, with a smaller one inverted into the neck of it ; and place it into a gentle sand-heat ; where it must remain, being sometimes shaken, till the vinegar has dissolved as much as it can of the verdigrise. Put it, then, into a proper glass for the decanting the clear fluid from the sediment ; and, when it has stood a due time to settle, let the fluid part be carefully poured off ; and evaporated to about one third. It must then be set to shoot in a receiver with a wide neck ; and, when the chrystals are formed, they must be taken out, and carefully dried.

A fresh proportion of vinegar may be added to the part of the verdigrise, which the first quantity left undissolved ; and the mothers, or fluid, remaining after the chrystals were formed, may be put to it ; and the
other

other parts of the process repeated as before: by which means, a second quantity of chrystals will be obtained.

Note.

The verdigrise, used for this purpose, should be chosen by its green colour, and transparency: for, where it happens to be dried to a greyish blue powder, it will require a greater proportion of vinegar to form it into chrystals.

The distilled vinegar produces the most beautiful chrystals: but common vinegar is more frequently used by those, who prepare them; as it is much cheaper, and will afford very good coloured chrystals, if care be taken, in the evaporation, not to suffer any part of it to burn to the glass.

This preparation is seldom used in medicine: but is of great value in some kinds of painting; as it will, when worked in varnish, retain its beautiful green colour; which far surpasses that of any other pigment: the great demand there is at present for this substance, on account of its being used for painting coaches according to the new taste, makes it well worth the notice of those, who are concerned in other chemical articles, to endeavour to prepare this in perfection.

Fictitious

Fictitious Roman vitriol.

Take twelve pints of water ; and drop, gradually, into it, five pounds of oil of vitriol, to which has been added half a pound of spirit of nitre : put the whole into a large glass receiver ; and add, to it, six pounds of copper, or brass, in filings, or thin plates : let it remain cold till the more violent effervescence, which will at first appear, be abated, and, then, place it on a sand-heat, which may be increased, occasionally, till the acid spirit appear to be saturated with the copper : let the fluid, then, stand at rest, till it become clear : when pour it carefully off from the feces ; and add some water to them, to bring off the remaining part of the solution, or to dissolve any crystals of the vitriol that may be shot : decanting off this washing in a less vessel, and of a more proper form than the receiver. Add this to the first fluid, and evaporate away half the quantity in a leaden boiler ; and then set the remainder in a large receiver to shoot into crystals, the crystals being
formed

formed and taken out, keep the mothers, or remaining fluid, to be added to a fresh quantity of the solution, in order to its affording the salt yet dissolved in it; or, if the whole be done for experiment, or on some particular occasion, the evaporation and crystallization may be repeated, till the whole quantity of the salt be obtained in crystals.

The fluid being drained from the crystals, when they are taken out, in an earthen cullender, the salt should be laid to dry in the shade; taking care, that no heat approach it; which, otherwise, would calcine the crystals, and hurt their transparency and beauty.

Note.

The Roman, or blue vitriol, is in many places found naturally produced: but not so copiously as to take away the necessity of preparing it by art; especially, where refuse copper, such as the filings and sweeping of shops, can be had in sufficient quantity, and the oil of vitriol can be obtained at the present low price: this manufacture, indeed, should be, as it is at present in one instance, joined to that of the oil of vitriol itself; as the unrectified spirit

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from

from the sulphur may be employed in it ; which makes a saving in the whole process.

The foreign Roman vitriol is not, in general, purely the salt of copper, but sophisticated either by nature, or art, with another body : but I shall avoid being more explicit on that point ; lest it give the hint to those, who prepare it here, to avail themselves of the knowledge of it, instead of continuing to make it pure, from the want of commodious means to do otherwise.

Excepting by this method, there is no danger of imposition in the Roman vitriol ; provided care be taken only to accept of none, but what shall be in chrystals of a large, or moderate size, and of a full deep bright blue colour.

SECTION V.

Of distilled waters and spirits, either not generally known, or to be made by cheaper or more compendious methods than are directed in the regular prescriptions for them.

Simple cinnamon water.

Take of cinnamon one pound, water sufficient to prevent an empyreuma, (or burnt flavour) : distill off one gallon.

Note.

This water is most frequently made by coction; the distillation, instead of improving it, making such a separation of the ethereal oil from the more soluble substances contained in the cinnamon, as renders it more incapable of remaining united with the water, without the aid of some other medium.

The simple cinnamon water, therefore, notwithstanding distillation is ordered in the processes both of the London and Edinburg colleges, is much better made in the following manner.

Simple cinnamon water by coction.

Take half a pound of cinnamon powdered grossly, and one gallon of water: put them into a very large kettle, or a still, and keep the fluid only of a simmering heat; that as little vapour may rise as possible; when it has thus boiled, in the gentlest manner, a quarter of an hour, return what may be come over into the still; and, being cold, strain off the water through flannel; and, after standing, decant off the clear part, if any sediment be found.

It may be prepared in less quantity in a mattrafs, with a long neck ; having a smaller mattrafs inverted to make a circulation ; and the operation may be performed in a sand-heat.

Note.

By this treatment a stronger water may be obtained by coction from half a pound of cinnamon, than can be had from a pound by distillation : for, though a pound will undoubtedly afford double the quantity of oil, yet from want of some saline, or other saponaceous medium, to cause a combination of the oil and water, the oil necessarily separates from the water, after the distillation ; and leaves it much less strongly impregnated, than where a less quantity is used, and the oil is not deprived of the saccharine juice, or other bodies of a saline, or sapid nature, which assist its union with the water, when only a gentle coction is used, to extract it from the ligneous part of the bark.

The cassia lignea is sometimes used for making simple cinnamon water, on account of its much lower price than cinnamon : but, if, the water be not made very weak, distillation must be used : because the cassia imparts a strong colour to the water ; which would distinguish it from the genuine.

In all other respects the cassia is equally good, for the purposes of making cinnamon water,

water, with the cinnamon itself; as the oils extracted from both are intirely alike: I am, indeed, fatisfied, upon very good authority, that they are the bark of the same tree; and the only difference lies in the choice and preparation of it, with respect to the age of the parts it is taken from, and the manner of curing it.

Spirituuous cinnamon water.

Take, of cinnamon, one pound, of proof spirit, one gallon, of water sufficient to prevent an enapyreuma: one gallon may be distilled off.

Note.

As the expence of cinnamon, in the proportion of one pound to a gallon, renders the preparation of this water very dear, a much cheaper method has been found of preparing it equally good, by substituting the cassia in the place of the cinnamon; and lessening, likewise, the quantity; the common cinnamon water is, therefore, prepared thus.

Method of making cinnamon water at a small expence, and equal to the best.

Take, of the best cassia lignea bruised, one pound, of melasses spirit, two gallons, of wa-

ter sufficient to prevent the burning of the materials : distill off two gallons : to which, when intended to be used as a cordial, add one pound of sugar, such as is sold at about eight pence per pound.

Note.

This quantity is only half the proportion of cinnamon, ordered in the college prescription above given ; but, if the cassia be good, it will yield as high a flavour as is agreeable to the palate ; a greater quantity of the oil producing a bitterness, and too great heat.

The use of melasses spirit will render this water much more soft and pleasant than it can be made from the common proof spirit : which is apt to be foul, and hotter to the mouth. But where the point is to make the expence as small as possible, common proof spirit may be used.

Simple spirit of lavender, commonly lavender water.

Take, of fresh lavender flowers, a pound and half, of proof spirit one gallon : distil, in balneo, till five pints be obtained.

Note.

As such a quantity of the lavender flowers would make this water expensive, it is very frequent

quent to join rosemary tops to them, and to make a much less quantity serve.

But there is another method of preparing this spirit more practised, than any of those where immediate distillation is used ; which is the commixing the foreign oil of lavender with spirit of wine without distillation ; and adding, likewise, a quantity of the spirit of rosemary, to save the using even too much of the oil of lavender, though the foreign oil can be purchased much cheaper than it can possibly be prepared here. The most artful mixture of this kind is as follows.

Extemporaneous and cheaper spirit of lavender.

Take, of the foreign oil of lavender, one ounce, of the oil of rosemary, in which one drop of oil of cinnamon has been put, half an ounce : mix them with a gallon of clean proof spirit.

Note.

This will appear very agreeable and strong ; for the oil of rosemary, with a very slight scent of that of the cinnamon, resembles greatly the lavender.

As this spirit, or water, as it is called, is principally prepared to be used as a scent, or perfume, these substitutions, or sophistications, are of a very excusable nature ; and, indeed, with respect to medicinal purposes, there is so

great an affinity, in the qualities, betwixt the lavender, and the substances used for adulterating, or counterfeiting it, that, if the proportion of oil be any way joined to the spirit, it cannot be shewn, that the medicine is depraved with respect to the intention; nor is it material, whether spirits of this kind are immediately distilled from the vegetable materials, or prepared from the oils already distilled; provided the union be perfect, betwixt the spirit of wine and the essential oil; and that the spirit of wine be previously rectified to a proper degree of purity.

Compound spirit of lavender.

Take, of simple spirit of lavender, three pints, of spirit of rosemary, one pint, of cinnamon, and nutmegs, each half an ounce, of red sanders, three drams: digest, and filter.

Note.

The design of the sanders, being only to colour the spirit, which has been usually made of a purplish red colour, the putting them to the ingredients before distillation, cannot possibly answer the end, in any degree; as no colour will rise from them in the distillation; they should, therefore, be infused in a part of the spirit, in a slight digesting heat, or without heat, if a considerable time be given to them;

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and

and then, the spirit being strained off from them, should be added to the whole quantity.

The compound spirit of lavender is, like the simple, frequently made by an extemporaneous preparation from the oils : and is not, when so managed, to be distinguished from that, immediately distilled from the vegetables, or from the spirit distilled from the oils, by adding spirit of wine to them.

The following method of making this compound spirit extemporaneously is the best, I have hitherto met with.

Extemporaneous and cheaper method of preparing the compound spirit of lavender.

Take, of red sanders, four ounces, of cassia lignea, two ounces, of Jamaica pepper, one ounce : having broken the cassia, and pepper, to a gross powder, put them together into a mattrafs with the sanders, with two quarts of spirit of wine ; and set them to digest, in a sand heat, sometimes shaking the mattrafs ; or, if they can be allowed to stand for a considerable time, this tincture may be best made without heat. After the due digestion, or infusion, let the spirit be strained off through flannel, to be added to a gallon of proof spirit ; into which

which, must be previously put, half an ounce of spirit of lavender, and an ounce of spirit of rosemary : the whole quantity of spirit will then be of a clear red colour ; but in order to give it that purplish full colour, which is esteemed best, a small quantity of the solution of any fixt alkaline salt must be added, by a few drops at a time, with such intervals, as may admit of the effect of each addition's being perceived on the colour of the spirit before another be made : and by this means the spirit may be brought to have any degree of colour desired.

Note.

The extemporaneous compound spirit of lavender may be prepared, likewise, with the same proportion of oils, as is correspondent with the process of the college above given : but this proportion is much more frequently used ; as the oil of rosemary is much cheaper than the oil of lavender ; and, with the addition of the spices, this variation in the quantities cannot be easily perceived ; nor in fact, with respect to the medicinal intention, can it be proved to make any material difference.

As the preparation of this medicine, from the essential oils, instead of the vegetables themselves immediately, does not, as we observed
before,

before, render it any way different from the regular process, this deviation may be tolerated: and, if there be any objection to it, the preparers are safe from the imputation of having done wrong, if they keep their own secret; for there is no possibility of distinguishing them.

Hungary water.

Take, of the fresh tops of rosemary, one pound and a half, of proof spirit, one gallon: distill, in balneo, till five pints are obtained.

Note.

The cheapness of the oil of rosemary, brought from abroad, has occasioned the Hungary water to be prepared in general, like the spirit of lavender, from the essential oil.

As this spirit is mostly designed for external purposes, where the scent is the principal quality regarded, it has been usual to add some proportion of the oil of lavender to it; there being a much less grateful smell in the rosemary alone, than when combined with the other: but a less proportion of the lavender will answer the purpose, if a very slight scent of cinnamon be added to the rosemary; which gives it, that aromatic sweetness, in which, principally, the lavender differs from it.

The Hungary water may be, therefore, easily prepared thus.

Cheap

*Cheap and extemporaneous method of preparing
the Hungary water.*

Take, of the oil of rosemary, in which one drop of oil of cinnamon has been put, one ounce and half, of the oil of lavender, two drams: mix them with ten pints of proof spirit of wine.

Note.

As it is very necessary, in this, and all the above cases, where no distillation is made after the oils are added to the spirit, to have it very pure, (which is not to be expected from the common proof spirit,) the kind called the rectified proof spirit, must be, therefore, from the distillers: but where that cannot be procured, the easiest method is to lower the rectified spirit of wine to the proof standard; and to use it instead of the other.

Aqua mirabilis.

Take, of cinnamon, two ounces, of rind of lemon peels, one ounce, of angelica seeds, lesser cardamoms, and mace, each half an ounce, of cubebs, two drams, of leaves of balm, six ounces: on these ingredients bruised, pour a gallon of French brandy;
and,

and, having infused them four days, distil off one gallon.

Note.

As the cubebs, galangals, and angelica seeds, do not yield an essential oil by distillation, they may be deemed unnecessary ingredients for the making this water : and the place of the angelica seeds may be supplied by a small proportion of the leaves.

The cassia may, likewise, be substituted here, as well in the cinnamon water, in the place of the cinnamon, and the quantity increased ; as may, likewise, that of the lemon peel ; for the water will not be rich with the proportion of ingredients here given. This water may be, therefore, more cheaply and efficaciously prepared in the following manner.

Method of preparing a more efficacious aqua mirabilis, with less expence.

Take, of cassia lignea, three ounces, of the rind of lemon peel, two ounces, of the lesser cardamoms, and mace, each half an ounce, of dried leaves of balm, six ounces, and of the dried leaves of angelica, one ounce : pour upon them one gallon of proof spirit ; and, having infused four days, add a sufficient

cient quantity of water, to prevent an empyreuma ; and distil off one gallon.

Note.

The mace and cardamoms might be omitted without impairing, in any material degree, the flavour, or efficacy of the water ; but, where the original form of the medicine is to be adhered to, they may be put in.

The king's honey water.

Take, of good French brandy, one gallon, of the best virginian honey and coriander seeds, each one pound, of cloves, one ounce and half, of nutmegs, benjamin, and storax, each one ounce, of vanilloes, in number four, and the yellow rind of the peel of three large lemons : bruise the cloves, nutmegs, coriander seed, and benjamin : cut the vanilloes into small pieces : and put all together into a cucurbit ; and pour the brandy on them : after they have digested forty eight hours, distil off the spirit into a retort with a gentle heat.

To one gallon of this water, add of damask rose water, and orange flower water, each
one

one pound and a half ; and of musk, and ambergrise, each five grains ; first grind the musk and ambergrise well with some of the water ; and afterwards put all together into a large mattrafs : shake them well ; and let them circulate, three days and nights, in a gentle heat ; and then let all cool : filter, and keep the water well stopt in phials for use.

Note.

This is the original process for the king's honey water, which Wilfon the chemist introduced into vogue as a medicine : it has since continued in use ; and is now esteemed ; but, principally, as a perfume ; which end it elegantly answers. The multiplicity of ingredients, many of them insignificant, are now, however, generally retrenched ; and even the honey, the former basis of the preparation, intirely left out of it. As the alterations have been made in this water, by many of the preparers, according to their own fancy ; there can be no recipe given for any certain kind as generally used ; but the following method will, if persued, produce a water equal to any hitherto made of this kind.

Method

Method of preparing an odoriferous spirit of the kind same with those now sold under the name of the king's honey water.

Take, of coriander seed, and yellow rind of lemon peels, each half a pound, of caraway seeds, four ounces, of cloves half an ounce : bruise the seeds, and cloves ; and put them, with the lemon peel, into a gallon of very clean proof spirit ; and, after having let them infuse for two days, add water sufficient to prevent an empyreuma ; and distil off one gallon.

To the aromatic spirit, thus obtained, add of damask rose water, and orange flower water, each one pint ; and take of musk, and ambergrise, each six grains ; and, having ground them well to a paste, with some of spirit, tie them in a linnen rag ; and infuse them, three or four days in the spirit, in a gentle heat ; pressing very slightly the rag several times during the infusion.

Note.

The Jamaica pepper may be substituted, in the preparation of this water, instead of the
cloves,

cloves, and nutmegs ; but, as the quantity is but small, the difference saved is not very material. An ounce or two of honey may be, likewise, dissolved in part of the orange flower or rose water ; and being freed from the dregs, may be added to the spirit ; which will impart a perceptible smell of honey to the whole, in a degree greater than the distilling the water from the honey can produce ; and this, giving a slight clamminess to the spirit, fixes the scent, and renders it more permanent than when the spirit contains none but volatile ingredients.

Anhalt water.

Take, of the best turpentine, half a pound, of olibanum, one ounce, of aloeswood, powdered, three drams, of mastick, clove-july flowers, (or rosemary flowers,) nutmegs, cubebs, or galangals, and cinnamon, each six drams, of saffron two drams, of fennel seeds, and bay-berries, each half a dram : powder them ; and, adding five pints of spirit of wine, digest them, for six days, with fifteen grains of musk, inclosed in a small linnen bag : then distil slowly, in balneo ; and separate the clear part of what comes over from the turbid.

Note.

Instead of the crude turpentine, two ounces of the oil may be, with more propriety, used.

The mastick, cubebs, galangal, saffron, fennel seeds, and bay-berries, affording either nothing by distillation, or what contributes very little, either to the odour or efficacy of the spirit, may be best omitted: the fennel seeds, particularly, are exceptionable, as depraving the scent.

Eau de carmes, or aqua melissa composita.

Take, of the fresh leaves of balm, four ounces, of the yellow rind of fresh lemon peels, two ounces, of nutmegs, and coriander seed, each one ounce, of cloves, cinnamon, and the root of angelica, each half an ounce: having bruised the leaves, and pounded the other ingredients, put them, with a quart of brandy, into a cucurbit; of which, stop the mouth; and set it in a warm place, to remain there two or three days: add then a pint of simple balm water; and shake the whole well together: after this distil guttatim in balneo, till the ingredients be left almost dry; and preserve the water, thus obtained, for use.

Note.

The angelica root may be omitted ; as it can impart nothing to the water by distillation.

In the place of the brandy, rectified proof spirit may be used.

By the simple balm water must be understood a simple water of the balm distilled with spirit : for if such water were made without spirit ; and added only to a quart of brandy, or proof spirit, in this preparation, and the materials distilled almost to dryness, the proportion of the aqueous fluid, to the vinous spirit, would render it so weak, as not to be capable of suspending the essential oils of the spices, and other ingredients. It is, indeed, contrary to art, and absurd, to use both the leaves of balm, and the simple water of it, in the same preparation, where a subsequent distillation is to be made ; because the augmenting the quantity of the leaves, and adding an equivalent proportion of brandy or spirit of wine, would answer the same end ; but as there is not any water ordered to be used, to prevent an empyreuma, I suppose it was found, that with so large a bulk of the leaves, proportionably to the quantity of fluid, it was impracticable to avoid their burning. It would be much better, nevertheless, to add two more ounces of the leaves of the balm, and a pint of the brandy or proof spirit, instead of the pint of simple balm water ; and, if enough of the spirit be made at one time to use the common still, to add also a proper proportion of water to prevent the solid ingredients from burning

when the due quantity is come over ; or otherwise to make the distillation in balneo, if the quantity of the spirit to be made be small : by either of which means, used according to the circumstances, an empyreuma may be avoided with the full proportion of leaves of balm to the whole spirit.

Eau d'arquebassade, or vulnerary water.

Take, of the leaves and roots of comfrey, of the leaves of sage, mugwort, and bugle, each four handfuls : of the leaves of betony, fanicle, and ox eye daisy, the greater figwort, plantain, agrimony, vervain, wormwood, and fennel, each two handfuls ; saint John's wort, long birthwort, orpine, Paul's betony, the lesser centory, yarrow, tobacco, mouse-ear, mint, and hyssop, each one handful : cut, and bruise them well, in a mortar : then put them into a large earthen-vessel ; and pour twenty pints of white wine upon them ; and stir the whole well together : close up the vessel ; and digest, in a warm dung-hill, or similar heat, for twenty days ; then put the whole into an alembic of pewter or copper tinned ; and distil off the
fluid ;

fluid ; which, when thus obtained, is the Eau d'arquebussade ; and must be preserved in a close stopped bottle.

Eau de luce.

Take, of the oil of amber, half an ounce, or more, of spirit of wine dephlegmated with tartar, one or two pounds : put them into a bottle, and let them remain there, for some days ; shaking them from time to time ; and the spirit will be thus strongly impregnated with the oil.

Take, then, what quantity you please of this impregnated spirit, or the whole, if you think proper : put it, with an ounce or two of the choicest amber, finely powdered, into a flask or bottle, and in a few days you will have a very rich tincture of amber. These are the previous preparations for the mixture called l'Eau de luce ; which is then to be made in the following manner.

Take, of the strongest spirit of sal ammoniacum, prepared with salt of tartar, one ounce, of the strong tincture of amber, pre-

pared as above, two drams, of spirit of wine dephlegmated with salt of tartar enough to dilute and volatilize the mixture ; that is, when the spirit and tincture are of the full strength, five drams ; which, when well mixed, give the genuine Eau de luce.

Those, who desire to have it perfumed, must mix lavender, or Hungary water, with the other ingredients, instead of the dephlegmated spirit of wine.

Note.

This process for the Eau de luce is, like most other of the French recipes for the preparation of singular medicines, very absurd and erroneous.

With respect to the spirit of wine, it is necessary for this purpose, that it should be highly rectified ; because, otherwise, when it is lowered with the water in the saline spirit, it will be rendered below proof ; and, consequently, not capable of suspending the oil of amber : but the dephlegmating with salt of tartar is not particularly material any other way than may regard convenience of method, as it does not give it any power of dissolving the oil of amber not common to any spirit rectified to equal strength.

The attempt to dissolve the amber, by spirit of wine impregnated by the oil, is a gross error :

ror: for whoever will make the experiment will find, that not the minuteſt quantity of amber will be diſſolved by this impregnated ſpirit: nor, perhaps, by any other menſtruum whatever hitherto known. This part of the proceſs is, therefore, wholly needleſs and impertinent.

The volatile ſpirit uſed ſhould not be very ſtrong of the volatile ſalt: for, otherwiſe, the greateſt part will be immediately ſeparated; as the addition of ſpirit of wine has this general effect on volatile ſpirits, by weakning the water as a menſtruum of the volatile ſalt.

The quantity of the volatile ſpirit muſt be proportioned, therefore, to the ſtrength of the ſpirit of wine: and muſt be leſs than one half, where the ſtrongeſt ſpirit is uſed, otherwiſe the oil of amber will ſeparate from the mixture.

The Eau de luce may be, therefore, better prepared, according to the very principles on which the above proceſs is founded, in the following manner.

More expedite manner of preparing the Eau de luce.

Take, of the higheſt rectified ſpirit of wine, either dephlegmated by the addition of ſalt of tartar, according to the directions given p. 145, or by diſtillation, one quart, of oil of amber once rectified, one

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ounce:

ounce : put them together into a bottle ; and let them stand some days, often shaking the bottle : then decant off the spirit from the oil remaining undissolved ; and add four ounces of volatile salt of sal ammoniacum dissolved in a pint of water.

If, on the mixture, the oil of amber appear to separate from the spirit, which will be seen by a white milky cloudiness, add highly rectified spirit of wine to it gradually, till the whole become clear ; and, if the volatile salt appear to separate, which may be perceived by the production of a great number of very white shining particles in the fluid, let it subside, and pour off the spirit from what is thus separated : for it is certain, from the nature of the separation itself, that a sufficient quantity of the salt remains.

If it be desired to have the Eau de luce perfumed, a dram of the oil of rosemary or lavender, or a mixture of both, may be added to the spirit of wine impregnated with the oil, before the addition of the volatile spirit to it.

Note.

Note.

By thus adjusting the proportion of the ingredients, according to their real power of action on each other, by which, a combination of them may be made, this preparation may be perfected without the miscarriages, to which the above process is unavoidably liable, from its error with respect to the relative quantity of some of the ingredients, and its uncertainty with regard to others: and it will, notwithstanding the apparent variation, be exactly the same, as it would if the directions of the former process were pursued, so as to produce a due mixture of the substances employed.

It is the practice in some shops of London, to aromatize the spirit of wine used for the Eau de luce; by distilling it previously from cinnamon, mace, nutmegs, and other spices: but this is a variation from the original process; and no improvement of the water, either as a medicine, or a perfume.

PART III.

Of galenical preparations, where deviations are usually made from the prescriptions of the college ; or where sophistications are frequently practised.

Confectio cardiaca.

TAKE, of fresh rosemary tops, and juniper berries, each one pound, of lesser cardamom seeds, husked, zedoary, and saffron, each half a pound : make a tincture of them, in about one gallon and a half of proof spirit : strain off the tincture ; and reduce it, by a gentle heat, nearly to the weight of three pounds and a half ; then, adding the following ingredients finely powdered, make them into an electuary ; of the compound powder of crabs claws, sixteen ounces, of cinnamon, and nutmegs, each two ounces, and of the finest sugar, two pounds.

Note.

This is the *confectio cardiaca* of the college of London ; which is ordered to be made in the place of the *confectio Raleighana* : how far it is a proper substitute, for that laborious preparation ; or with what propriety it is composed to answer the medicinal intention of its use, it is not my business to inquire here : but as there is an error in the proportion of the ingredients, which renders its consistence very incommodious, even for present use, and improper with regard to keeping good the medicine for any longer space of time, it may be no useless part of this work, to point out the defects of the prescription, with respect to the form of the medicine ; and to show where they may be remedied. The principal fault lies in making the quantity of the fluid of the extract far too great, for the proportion of the powders and sugar : for, as the extract gains very little tenacity from the ingredients, which are the subject of it, the powders, finding little or no viscosity to suspend them, necessarily sink to the bottom ; and, this separation of the ingredients renders it very difficult, consequently, to measure out doses, which may contain equal proportions of them ; and, what is still much worse, the proportion of sugar, not being one third of what is found necessary, in order to the preventing fermentation in syrups, (for the quantities directed by the college them-

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selves

selves for syrup are two pounds of the sugar to one of the fluid; whereas, there is here only two pounds of the sugar to three and a half of the fluid) the medicine is, consequently, spoiled by its fermenting, as soon as the warmth of the season disposes it to that state: and, as it neither can be made in very small quantities, nor is of so frequent use, as to render the renewing the stock very often practicable, this quality occasions a very great loss to those, who prepare it according to the above prescription.

It is necessary, therefore, to change the consistence of this medicine, without altering the proportion of the ingredients; which might be done by wasting the fluid to one pound: but then every dose prescribed would be, virtually, almost one third greater than it ought, according to the original form: to avoid which inconvenience, as well as that arising from a close adherence to the prescription, the most proper method is to waste a small part of the fluid; and to add an equivalent proportion of some other substance, which may contribute to inspissate the remainder in such manner, that the powders may be duly suspended, and the aptitude to fermentation at the same time removed. This may be affected by gum arabic or starch previously boiled; which will produce the desired effect without interfering in the least degree with the efficacy of the medicine.

The spirit of wine in the above prescription is ordered to be evaporated: but that is a needless waste of it, as well as of the oil raised from
the

the rosemary; which, by a proper treatment, would produced six pints of Hungary water, without the least difference to the extract, if the spirit of wine be divided into two proportionable parts, and the rosemary tops distilled with one part separately, and the other ingredients with the other: nor will that part of the spirit, distilled from the juniper berries, &c. be rendered of no value by the admixture of what rises from those ingredients: for it will be converted into one of the best and most palatable kinds of Geneva, that can be imagined.

The following method, therefore, of preparing the *confectio cardiaca* will be found very advantageous; and productive of a due consistence of the medicine, without in the least altering either the proportion or quality of the ingredients.

More profitable method of preparing the confectio cardiaca; without the defects found in it, when made according to the form of the college.

Take, of fresh rosemary tops, one pound: add to them six pints of proof spirit, and one quart of water, to prevent an empyreuma: put them into a proper alembic; and distill off six pints.

Take,

Take, also, of juniper berries one pound, of the lesser cardamom seeds husked, zedoary, and saffron, each half a pound : add to them another gallon of proof spirit ; and, after digesting some time, put them, also, into a proper alembic, with a quart of water, and distill off one gallon.

Put what remains, after both the distillations, together into a proper vessel ; and evaporate it, till there remain only three pounds ; adding, in the mean time, of gum arabic two ounces, and of starch one ounce ; dissolve, then, in this extract, two pounds and a half of sugar ; and, lastly, mix with it, the sugar being first dissolved, a powder compounded of sixteen ounces of crabs claws, two ounces of cinnamon and nutmeg, and one ounce of cloves.

Note.

By this reduction of the quantity of the fluid, and inspissating the remainder by the gum arabic and starch, together with the augmented quantity of the sugar, the composition is rendered of the due consistence of an electuary, without altering the weight of the whole, or changing the proportion of any of the ingredients ; except

cept the sugar, of which, the half pound, to allow for the evaporation of part of the fluid, cannot be supposed to make any difference in the efficacy of the medicine.

By distilling the rosemary with the proportion of spirit of wine here directed, six pints of Hungary water is gained without the least injury to the extract : as is, likewise, by the same means, a gallon of Geneva, equal to the best made in Holland, for the additional expence of half a gallon of proof spirit.

Gascoign's powder.

Take, of prepared pearls, crabs eyes, red coral, the whitest amber, calcined hartshorn, and oriental bezoar, each one ounce : of the tips of crabs claws powdered, the weight of all the others : make them into a fine powder ; and afterwards form them into balls, by means of a solution of gum arabic.

Note.

This composition, which, from the caprice and folly of mankind, has been in very great vogue, differs materially from other testaceous powders in nothing, but the very great expensiveness of some of its ingredients. It has, therefore, been seldom prepared with a strict conformity to the prescription here given ;
which

which is that of the former edition of the Dispensatory of the London college ; but altered, according to the fancy or parcimony of the preparers ; and now most frequently excluded from the shops by the substitution of a counterfeit mixture, which does not contain even one of the proper ingredients. But before I give the recipe for this absolute counterfeit, I will give one for such, as avoiding the most costly of the ingredients, at the same time comprehends all that are materially necessary.

Cheaper method of preparing Gascoign's powder without altering its efficacy.

Take, of crabs claws seven ounces, of calcined hartshorn, and amber, each one ounce, of the seed of the amomum Plinij, dried and powdered, two drams : all the ingredients being levigated together, make the mixture into balls, by a solution of gum Arabic.

Note.

The crabs claws being no way different, with regard to their medicinal virtue, from the pearls, coral, or crabs eyes, the quantity of it is increased to supply their place ; and the seeds of the amomum, which have been discovered to give the colour when rubbed on paper, which was made the test of the genuineness of this

medicine, is, on that account, added in the place of the bezoar: and this composition is in fact equally good with that prepared in the most expensive manner, as all the bodies of the testaceous kind have the same qualities; and coral, though differently produced, has a strict affinity with them. But cheaply as this may be prepared, the common substitute, above-mentioned, for the Gascoign's powder deviates wholly from it; being composed of substances varying even from the nature of the true ingredients; as it is composed of fossile earths, instead of the testaceous parts of animals; and, therefore, according to what we before observed in the introductory part, essentially different. But that the imposition may be the better known, I will give here the recipe for the preparation.

Method of preparing the counterfeit Gascoign's powder commonly sold.

Take, of chalk, one pound, of tobacco-pipe clay, dried and powdered, half a pound, of the seed of the amomum Plinij, half an ounce: levigate them well together; and form them into balls.

Note.

This clumsy mixture has so much the appearance of the Gascoign's powder, that from the resemblance, and the cheap price it is sold for

for by those who prepare it, (which I believe is not more than four or five shillings per pound,) it has become the common sort used; especially in the country where preparations of this kind are generally had from druggists, who neither know nor care any thing more about medicines, than where such as are passable may be most cheaply purchased.

As it is of some consequence, therefore, to be able to distinguish this counterfeit from the other kind, I would advise the putting a ball of any suspected into the fire; which, if it be composed of tobacco pipe clay and chalk, will harden; but, if of the testaceous substances proper to the medicine cemented together with gum Arabic, will grow soft and crumbly: the gum Arabic which caused the tenacity, being destroyed by the fire, and the testacea calcined.

Goa stone.

Take, of hyacinths, topazes, sapphires, rubies, and pearls, each an ounce, of oriental bezoar, white coral, and red coral, each two ounces, of emeralds, half an ounce, of musk, and ambergrise, each two drams, of leaves of gold, number forty: let all be levigated into an impalpable powder; and, with rose-water, made into a paste; which is to be formed into long or oval balls, and polished.

Note.

The great expensiveness of the precious stones in this preparation, from which, likewise, it receives not the least addition to its efficacy, has occasioned substitutions of various kinds to be made for it: in which, also, the admixture of the leaf gold, with the other ingredients, has been omitted; as it was no way necessary, but for the gilded appearance, that may be equally well produced with a much less quantity used differently.

The Goa stone, therefore, according to the present usage of the shops, may be prepared in the following manner.

Method of preparing the Goa stones, as they are now found in the shops.

Take, of crabs claws levigated, eight ounces, of oyster shells levigated, four ounces, of musk, and ambergrise, each two drams: mix them well; and make them into a paste with rose water, in which gum arabic is dissolved, in the proportion of a dram to two ounces: make this paste into round or oblong balls; and, when they are dry, dip them in a strong solution of gum arabic; and roll them on leaves of gold, till their surface be wholly covered; and,

when again dry, rub them with a cloth to give them a polish.

Volatile tincture of bark.

Take, of the Peruvian bark, four ounces, volatile spirit of sal ammoniacum, two pints, digest them, without heat, in a vessel well closed; and strain off the tincture.

Note.

The college have directed no volatile spirit to be made but with fixt alkaline salt; and wholly prohibited the use of lime for that purpose: now this tincture cannot be made of any volatile spirit but what is prepared with lime; for with the spirit made by fixt alkaline salts, nothing can be produced but a thick mucilage from the infusion of the bark: from which circumstance, many, who have attempted to make this tincture, have miscarried; and found it impracticable.

Whoever, therefore, would prepare this medicine, must use volatile spirit of sal ammoniacum made with lime, instead of that made by fixt alkaline salt.

Balsam of sulphur.

Take, of olive oil, one pound, of flowers of sulphur, four ounces: put them into a

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pipkin;

pipkin, that will contain about three times their quantity ; and set it over a fire, and make the matter boil gently : keep it continually stirring, with a wooden spatula, for the space of an hour and half, till it is quite cool : and put it up for use.

Note.

This is conformable to the prescription of the college of London : but the medicine is generally made in a cheaper manner ; by substituting the linseed oil instead of that of olives ; by increasing the quantity of sulphur ; and by using the crude or roll sulphur instead of the flowers : for which method of preparation this is the general process.

Common method of preparing balsam of sulphur.

Take, of linseed oil, one gallon, and of crude, or roll sulphur, four pounds : put the oil into an earthen pipkin, which will hold about two gallons ; and set it over a fire, that will only make it boil in the most gentle manner : powder the sulphur ; and throw it, gradually, into the boiling oil ; at first in greater quantities, and afterwards more gradually ; stirring the mixture, with a wooden spatula ;

spatula ; and letting one quantity be dissolved before another be added ; when the whole quantity of sulphur is dissolved, the preparation is finished.

Note.

By this means, the balsam of sulphur is prepared at a very small expence : and, though in the most regular manner the cost is so little, that there seems no temptation to deviate from it ; yet the farriers, who make the principal demned for it, use it in such large quantities, that the greatness of the consumption makes it worth while for the wholesale dealers to consult of such savings, as are made by this process.

With respect to its use in regular medicine, the substitution of linseed, for olive oil, is not very exceptionable : there is indeed so little apparent foundation, for a preference of either, that the college of Edinburg have left it wholly to the choice of the preparer, which to employ.

The use of crude sulphur, instead of the flowers, is not much more to be objected to ; for they differ only in purity : and, if the roll sulphur be good, no difference will be found in the medicine.

As to the efficacy of the medicine, one would imagine, that the increase of the quantity of sulphur would be rather beneficial than other-

wife : as the oil can only be considered, as the vehicle of it. The only reason, therefore, of limitation of the proportion, seems to be ; that, if too much sulphur be added, the fluid form of the mixture, which it will retain with this quantity, is apt to be destroyed : as I have frequently seen, where a yet greater quantity of sulphur than is here directed has been used : and this renders it incommodious to take out of the vessels when it is sold, or used.

Acid elixir of vitriol.

Take, of cinnamon six drams, of lesser cardamom seeds husked, three drams, of long pepper, and ginger, each two drams : infuse without heat ; and filter off the tincture : to this add of oil of vitriol, sixteen ounces ; and filter,

Note.

This medicine is seldom prepared for sale according to the prescription of the college here given, the quantity of the spices being so small, that they neither produce the resemblance, in scent or colour, of the former elixir ; and therefore, render this composition less agreeable to those, who are accustomed to the other.

The former prescription of the college ordered twelve ingredients to be used, besides the
spirit

spirit of wine, and oil of vitriol ; but a great part of them, being unnecessary ; and some of them absurd with respect to the intention, are generally omitted ; and other proportions of the remaining are employed in their stead : the Jamaica pepper has been substituted by several instead of some of the dearer spices ; not being easily distinguishable, in the tincture, from them. The essential oils of sage and mint have been some times used, instead of the leaves ; and are now ordered by the Edinburgh college : but, as the London college wholly omit both, the following recipe, if any substitution be allowed, may be considered as one of the best ; as, by it, not only a strong tincture for the elixir is made, very cheaply, but the composition is greatly correspondent to the above prescription ; at the same time the appearance of the medicine will be rendered very conformable to that of the old established elixir.

*Cheap method of preparing the elixir of vitriol,
in the most perfect manner.*

Take, of proof spirit of wine, two pints, of Jamaica pepper, one ounce and half, of cassia lignea, and ginger, each one ounce : pound the spices ; and put them, with the spirit of wine, into a mattrafs with a circulating head ; and, after an infusion of
several

several days, strain off the tincture : to which add sixteen ounces of oil of vitriol very gradually.

Note.

This tincture being much more rich of the spices, than that made according to the college prescription, will have a much stronger scent ; and acquire, after keeping some time, the red colour, which is produced by the action of the oil of vitriol on the essential oils of the spices, and is necessary for the saleable appearance of this medicine ; and, if the spices can be supposed to add any efficacy to the composition, this must be preferable to that prepared by the regular process ; where the quantity in a dose is so minute, that no possible effect can be expected from it.

Sweet elixir of vitriol.

Take, of cinnamon six drams, of lesser cardamom seeds, husked, three drams, of long pepper, and ginger, each two drams, of proof spirit of wine, two pints : infuse without heat ; and filter off the tincture : to which, add of spiritus vitrioli dulcis sixteen ounces.

Note.

This is the prescription of the college of London, for the sweet elixir; and is, in fact, a substitution for Vigani's elixir of vitriol, which the college of Edinburg, omitting the green colour, have adopted as the only kind directed by them. But as the demand for Vigani's is yet continued, and the preparation of it kept as a secret in the hands of some particular people, I will here give the method of making it.

Vigani's elixir of vitriol.

Take, of the blades of green corn, or the leaves of spinage, a proper quantity: bruise them well, in a mortar of glass or marble; and then press out the green juice from them: put two ounces of this green juice, or as much as will raise the desired colour, into a pint of spiritus vitrioli dulcis; and add to it, dropping them in very gradually, of the oil of mint, two drams, of the oil distilled from lemon peels, and nutmegs, (or Jamaica pepper), each one dram: incorporate them thoroughly; and, if any small quantity of the oil remain unmixed, let it be taken away by means of a separating funnel.

Or,

Or, an ounce of Jamaica pepper, dried leaves of mint and lemon peel, the two first being powdered, and the last bruised, may be infused, with a gentle heat, for some days, in a pint of spiritus vitrioli dulcis coloured as above; and the tincture then poured, or strained, off from the dry ingredients.

Note.

The green colour of this elixir is the secret, which has kept this preparation in particular hands; but it may be produced by the above means; or by infusing the seeds of the amomum Plinij, in the spiritus vitrioli dulcis, together with saffron, or yellow sanders.

Daffy's elixir, or elixir salutis.

Take, of jalap, one pound and half, of sena, leaves, half a pound, of aniseed, three ounces, of coriander seeds, two ounces, of orange peel, one ounce, of proof spirit of wine, one gallon: having powdered the jalap, and bruised the seeds, infuse them for eight, or ten days; after shaking the vessel.

Note.

The sale of compositions under the name of Daffy's elixir, being very great, many persons have

have made the preparation of it, with a few other things of a like kind, their particular business; and all methods have, therefore, been tried to prepare it as cheap as possible. The principal view is to have a cheap purgative joined to the anise and coriander seeds, instead of the using the senna alone; and this is best done by the jalap; which neither gives the bitter flavour, nor is apt to gripe, as the aloes, its rival in cheapness. This prescription may, therefore, be esteemed the best for the Daffy's elixir, both for the palatableness and mild efficacy: and the proportion of the purgative ingredients is nearly correspondent to that of the college tinctures.

Syrup of capillair.

Take, of maiden hair, one ounce, of liquorice sliced into thin bits, two ounces: pour upon them a quart of boiling water; and let them infuse in it one day: then strain off the fluid through flannel; and dissolve in it, being set on the fire in a proper vessel to boil; four pounds of eight-penny sugar; taking off the scum as it rises: as soon as the whole of the sugar is dissolved, and the syrup has boiled eight or ten minutes, take it off the fire: and, when cold,

cold, add two ounces of orange flower water ; mixing it well with the syrup by stirring, or shaking them together.

Note.

The constant use of this syrup at coffee-houses, and elsewhere, as a regale, has occasioned it to be prepared in the cheapest manner that could be contrived ; which has been first by using only the syrup of sugar, and a little orange flower water ; and afterwards omitting even two or three parts of the proper quantity of sugar, and thickning the syrup with starch, in order to make it appear of the due consistence, and to prevent its fermentation, which would otherwise necessarily happen. But those who are not disposed to enter into such fraudulent practices, and would prepare this syrup genuinely cheap, may use the above prescription ; which differs only from the officinal ones in lessening the quantity of the maiden hair, that, in a greater proportion, would render the syrup bitter and unpalatable.

PART IV.

Of the substitutions and adulterations, commonly practised with respect to the simples; and the proper methods of detecting them in each instance.

Adulteration of quicksilver; and the means of its detection.

QUICK SILVER, though of at least equal importance with any other medicinal simple, is, perhaps, more frequently adulterated than any other: and, by that means, rendered greatly unfit for those preparations, where it does not undergo a sublimation; as in the several precipitates, æthiops mineral, and alcalifate mercury.

The adulteration is made by amalgamating lead or tin with the quicksilver; which metals it readily dissolves, and apparently assimilates with itself.

As this adulteration, particularly with lead, ought to be carefully guarded against, where quicksilver is used for the abovementioned

tioned purposes, it ought always to be proved by a proper test.

The easiest means of doing this, where the adulteration is great, is by straining it through leather; in which, if it contain beyond a certain proportion of lead or tin, a pasty metallic matter will be left; being an amalgama of the two metals: but, if the adulteration be small, this proof will not discover it; and the following method should be used.

Put any quantity of the quicksilver suspected into a crucible; and give it such a heat, as will dissipate it in fumes: after which the tin or lead, if there be any, will be left in the crucible; and being examined and weighed, not only the nature, but the proportionate quantity of the adulterating matter in the quicksilver, may be with certainty known: so that, the quicksilver may be either purified for the uses, which require it, according to the means directed p. 208; or applied to the purposes where purity is not essential; proper allowance being made for the defect in quantity
of

of the real quicksilver, proportionably to the weight caused by this adulteration.

Substitution for native cinnabar.

The native cinnabar bearing a considerable price, the factitious cinnabar, which, when prepared with a great proportion of sulphur, extremely resembles it, is very frequently substituted for it.

As they are in fact the same, the native cinnabar, as well as the factitious, being only a combination of quicksilver and sulphur, and that, likewise, in various proportions in different parcels, there is no possibility of discovering this substitution : and it is best, therefore, to avoid the use of this substance as a medicine ; and to be satisfied with the factitious under its own name ; as there can be no certainty, in the common course of practice, of having the genuine native ; and as, when it is had in the most genuine state, it is no way different from the factitious, but in the manner of its production.

*Adulteration of white lead, or ceruss; and
the means of its detection.*

White lead, though of small price, yet being consumed for the purposes of painting in great quantities, is, for the most part, adulterated by the manufacturers, or wholesale dealers in it; and, in this state, consequently, procured for the most part as a simple in medicine.

The common adulteration is with chalk or talc; as being the cheapest ingredients, with which it can be sophisticated: this, in a lesser degree, is of no great moment with regard to the medicinal uses of this substance, which are principally for the making plaisters, or unguents. But, in a greater proportion, such mixtures of heterogeneous matter deprave it highly for some applications.

The adulteration may be, therefore, examined most easily, by comparing a piece of what is suspected with another piece, known to be pure, of equal bulk; and the difference of weight will shew the fraud,

fraud, where the sophistication is in a great proportion. But, where the quantity of adulterating matter is less, or the proportion of it would be more exactly known, the following manner should be used.

Take an ounce of the white lead suspected; and mix it well with about half an ounce of pearl-ashes, or of any fixt alkaline salt, and about a quarter of an ounce of charcoal dust; and, having put them into a crucible, give them a strong heat. The lead will, by this means, be reduced, to its metallic state; and, being weighed, will shew, by what it may fall short of the weight of an ounce, the proportion of the adulteration: about a tenth part being allowed for the corroding acid of the white lead.

Adulteration of red lead, or minium; and the means of its detection.

The red lead is neither so frequently nor largely adulterated as the white: because of the visible effect any admixture of such in-

gredients as are of less value would have on its bright colour. It is, however, sometimes adulterated with red oker; which may be perceived, by comparing the sophisticated with a specimen of the true, from the foulness which will be produced in the bright orange colour. But any adulteration may be with certainty known by reducing it to its metallic state, through the means above given for the white lead: the pearl-ashes being in this case omitted.

Substitution for gum arabic.

The gum senegal, which can be afforded at a much cheaper rate, is very frequently sold or used for medicinal purposes in the place of the gum arabic: but as they are, as far as appears, alike in their qualities with respect to their use in medicine, it is not a very hurtful fraud.

As it is proper, however, to prevent impositions with respect to price, that they should be distinguished: whoever has occasion may discern the difference, by the dry and brittle consistence of gum arabic; the

the other being clammy and tenacious, like the gums produced, in our own country, from the plumb or cherry trees.

Substitution for the true sperma cæti.

The form and consistence of sperma cæti not being owing to the state or nature of the oil, of which it is made, when taken from the whale, but to an artificial concretion produced by the addition of saline bodies, the same art is practised on other animal oils; even on the most feculent part of the train oil, and that extracted from pilchards: and the fictitious sperma cæti, thus prepared, is sold, and used, in common, with that prepared from the proper part of the fat of the whale.

As, however, the nature of animal oils is the same in all respects, except with regard to consistence, and their sweet or putrid state, and as all such oils are rendered alike solid and sweet, by that treatment of them, by which the sperma cæti is prepared, the substitution of train, or other oils, instead of that originally used, cannot be accounted

an injurious fraud, with respect to medicine ; and, with respect to other purposes, it will be a very valuable improvement.

Substitution for cinnamon.

The cassia lignea is, for most purposes, substituted for cinnamon, by those who study the cheap preparation of medicines : it is, likewise, very frequently mixed with the true cinnamon ; and sometimes sold intirely for it.

With respect to the medicinal efficacy, this substitution may be considered as allowable : for there is no experimental difference to be found in the essential oils (in which alone the efficacy of this drug lies) betwixt the two kinds : and a very ingenious gentleman, whose veracity cannot be questioned, after having particularly taken upon him to inquire after this matter in the East-Indies, is satisfied, that they are the bark of the same tree ; and only differ in the manner of curing, and the choice with regard to the parts and age of the tree.

The cassia, however, as it is here imported, may be easily distinguished from the cinnamon, by those who have occasion, from a sweet mucilage, which it affords on taking it into the mouth, where it seems, if good, almost wholly to dissolve : whereas the cinnamon tastes hotter ; and has a bitter dryness in the mouth : the cassia, likewise, shews itself, when infused in spirit of wine, by imparting a strong yellow colour to it, not found in near so great a proportion in the cinnamon : the quills of the cinnamon bark are, likewise, generally much thinner and smoother than the cassia.

Adulteration of vinegar ; and the means of its detection.

Vinegar prepared in the great works near London is generally adulterated with oil of vitriol. This sophistication does not, however, greatly injure it for medicinal uses, when it is not in a great degree : but where, as I have seen it, a considerable part of the acid is only from the oil of vitriol added,

the using such for distillation, or for making the sugar of lead, and several other purposes, is attended with great loss and inconvenience.

In order, therefore, to distinguish the vinegar so adulterated from the purer, where the taste is not thought a sufficient evidence of this fraud, the following method may be used.

Take a quart of the vinegar; and boil it down to about two ounces: into the remainder, put two drams of any fixt alkaline salt: which, being dissolved, pour on two or three ounces of water; and filter the solution: evaporate, then, the fluid to about half an ounce; and, if there were any oil of vitriol in the vinegar, chrystals of the vitriolate tartar will be found; which may be easily known by their taste, or peculiar form similar to that of the mineral chrystal, only with a greater thickness proportionably to their length.

The residuum in the retort, or vessel, after the distillation of vinegar may be used for this trial instead of the vinegar itself: by
which

which means the evaporation may be saved; and, as a considerable quantity may be this way used without expence, the proportion of the oil of vitriol may be nearly ascertained by the quantity of tartar vitriolate produced, which may be separated, from the sal diureticus that will be formed from the remaining part of the acetous acid, by a careful chrySTALLIZATION.

Sophistication of saffron.

The foreign saffron is almost constantly sophisticated with oil ; by which means the weight is increased in a great disproportion to that of the pure saffron ; and the flavour of it, also, frequently depraved. It is usual, moreover, for dealers in medicine to prepare the foreign saffron, by extracting the oil from it, and pressing it into cakes of the same form with those of the English ; and to pass it off for the English ; to which it is greatly inferior in all respects.

This imposition cannot be discovered by any other means, than the learning the true
appear-

appearance of the best saffron, or the keeping a good specimen to compare with any that may be questionable: where the strong aromatic smell, and deep clear colour, will easily shew the difference betwixt the foreign and English.

Adulteration of pearl-ashes.

The pearl-ashes, which both from the adoption of them by the college, and their frequent use in the chemical practice, are now become a material simple, are, for the most part, adulterated with sea-salt in a greater or less degree. As the sea salt is of an innocent nature, there is no great mischief arises from this, when in a moderate degree: but where the adulteration is great, a loss arises from the deficiency of the fixt alkaline salt, in the preparations where the pearl ashes are used. In order, therefore, to guard against the taking any such, it is very proper to try them, by laying a little on a red-hot poker; where, if any quantity of sea salt has been added after the pearl ashes have been calcined, it will inevitably show

show itself by its decrepitation or crackling noise.

Substitution for pearls.

It is usual, where prepared pearls are to be used or sold, to substitute prepared oyster shells in their place ; which, when reduced to impalpable powder, are indistinguishable from them, being in fact the same substance ; for which reason it were to be wished that the college had thrown them out of the materia medica in the late reformation of their pharmacopeia : and that the credulity in old forms did not give so much occasion to imposition of this kind ; which, however innocent with respect to the medicinal consequences, are yet a sort of commercial fraud, that will be unavoidably practised, while authority countenances the prescription of substances very scarce or dear, which have others resembling them in appearance, and agreeing with them in their qualities.

Substitution for crabs eyes.

As prepared oyster shells are substituted for pearls, so crabs claws are, for the most

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part,

part, sold or used, where crabs eyes are demanded or ordered ; and for the same reason : there being, in fact, no difference betwixt them, but the form in which, and situation where, they are produced in the crab.

These ought, therefore, along with the pearls and other such substances as have no essential superiority over the rest of the genus to which they belong, and are difficult to be collected, or of great price, to be excluded from the materia medica : by which means, the preparers of medicines would not have their conscience forced by the temptation, the opportunity of practising the arts of sophistication and substitution gives, while costly medicines are in use : nor would the prescribers or purchasers be liable to such deceptions ; but certain in general of really having what they wrote, or paid, for.

Substitution for the testacea in general.

Chalk is very frequently substituted for, or mixed with, all the prepared testacea.

This

This is much less allowable, than the changing any of the testacea for each other ; for, though chalk be, as well as the testaceous genus, of an alkaline nature ; and will neutralize acids in the *via prima* to a certain degree ; yet it will much less effectually do so than the others ; and has, besides, a styptic astringent power, by which, it increases costiveness, in many habits, to a very detrimental degree.

The method of discovering where chalk is substituted for, or mixed with, the testaceous earths, is to pour oil of vitriol upon the suspected quantity ; which will readily dissolve the testaceous earths, but leaves the greatest part of the chalk unchanged ; by which means, the fraud may be easily detected. But this is not practicable where the testacea have undergone a strong calcination ; for, being rendered of a calcareous nature, they have then a great affinity with chalk ; and will resist the solvent power of the oil of vitriol, when they are divested of their sulphureous or phlogistic part.

Chalk

Chalk may be, likewise, distinguished from the levigated testacea, by the taste; which is much more austere and rough in the first, than in the others: but this criterion cannot be extended to a mixture of them, where the proportion of the chalk may be small.

Substitution for the buckthorn berries.

The buckthorn berries being one of the most common cathartic medicines, and consequently used in a considerable quantity, it is very frequent for those, who collect them, to put off in their place, and intermix with them, the berries of other trees and plants; particularly those of the frangula, or black alder, which greatly resemble them in their appearance.

As this ought to be carefully guarded against, on account of the error it may occasion in the strength of the syrup of buckthorn, which is a medicine frequently much depended upon, it is proper to examine well such parcels of berries, as are not had from the hands of those who can be well con-
fided

sided in : and the true buckthorn berries may be distinguished, by their three cornered seeds, with a purplish juice intermixed with green.

The juice of the buckthorn berries, which is sometimes bought of those who gather them, and express it to save the carriage of the berries; where they are to be disposed of at a distance, is very liable, also, to be adulterated by the admixture of water, or any other fluid which may resemble it. Against this there is no means of security, but the avoiding being concerned with the juice already extracted from the berries; and using them alone, as they may, generally, be as easily procured, as the juice, with a small difference in the proportion of the price.

Substitution for oil of cinnamon.

The essential oils of the cassia and cinnamon, (and probably the trees affording the barks) as we have observed before, being the same, the oil of cassia is in general substituted for the other, it being now a common

mon practice at Bencoolen, and other places in the East-Indies, as well as in England, to distill it for that purpose.

As it is so much a doubt, whether there be any difference in nature betwixt them, there can consequently be no artificial means of distinguishing them : nor for the same reason any just ground of solicitude about such means.

Substitution for oil of cloves ; with the adulteration of the genuine.

If Jamaica pepper be distilled, it affords an oil greatly resembling that of cloves, both in its appearance, flavour, and scent. It is, therefore, frequently mixed with the oil of cloves ; and sometimes put off for it.

There is no method of distinguishing this fraud, but by comparing a specimen of pure oil of cloves with what is suspected ; and judging by the colour and scent ; the true oil of cloves being of a lighter orange brown colour, and a much higher aromatic smell, than that of the pepper ;
which

which has a more thick black appearance, and fainter odour.

The oil of cloves is, likewise, frequently adulterated with the oil of olives, or of linseed; which may be discovered by placing some of it, in a phial, in a cold cellar: where, on standing at rest, for a long time, the oil of cloves will shew itself separated, by subsiding to the bottom. This fraud may, also, be discovered by dropping the oil of cloves into very highly rectified spirit of wine, and mixing them well by shaking; where, being attracted by, and combined with, the spirit, the oil of olives will swim on the surface, or appear in small globules.

Adulteration of essence of lemons.

The essence of lemons is frequently adulterated, as well as the oil of cloves, by the admixture of common oils. The fraud may be discovered, in the same manner, by its admixture with highly rectified spirit; or by distilling any quantity of it, in a small retort, with water; where the essence rising will be rectified; and leave the oil behind in

the retort, floating on the remains of the water.

Sophistication of oil of lavender.

The oil of rosemary having a scent, which has some affinity with that of lavender, as well as being like it with respect to colour and consistence, and of a much lower price, is frequently mixt with it.

This is of no great consequence, where the oil of lavender is used as a medicine, their nature being very much the same; but, where the imposition may be thought of moment with regard to the price, it may be discovered, if not in a very small degree, by comparing a specimen of the genuine oil with that which is suspected: when the bitterish and more oily scent of the rosemary will be a sufficient means of discrimination to those who have an acute smell.

Substitutions practised with respect to rhubarb.

The rhapontic is very frequently sold, or administered, in the place of the true rhubarb;

barb ; to which it is supposed to be inferior in its medicinal qualities.

The true rhubarb may be distinguished from the rhapontic, by those who are conversant with drugs, by the grain and colour : but the more obvious difference will be found on chewing : when the rhapontic dissolves quickly, by means of the saliva, into a mucilage of a very tinging yellow colour ; and affords an earthy and much more disagreeable flavour than the rhubarb.

There are two kinds of rhubarb at present brought to England, the one is called the Turkey kind, which bears much the highest price, being in general of finer appearance ; the other the Russian, but now more frequently brought from China. As the latter is commonly brought in the private trade, by the persons employed in the service of the India company, it is purchased of them, in large parcels, at a very low price, by those who are in the secret of this advantage ; and by them sorted into different kinds. The best pieces being picked out, and cut into a proper form, and freed from all worm eaten, or other depraved parts, is sold for Turkey rhubarb ;

and the next best under some other proper denomination ; while the worm-eaten, or other unfightly parts, are used for tinctures or syrups : and, by this management, a very considerable profit is made.

Substitution for bezoar.

The oriental bezoar being of great price, the gall stones, found in the gall bladders of oxen, are frequently substituted for it ; being of the same nature : but, as even these are scarce, and not to be procured frequently, the gall itself of oxen, or sheep, is most usually put in its place.

It is not, however, of any moment, what innocent substances are used in the place of bezoar : the medicinal virtues of it being imaginary ; and the drug itself now so little considered, in any regular practice, that it is excluded from the materia medica in the last edition of the college dispensatory.

The true bezoar itself may be distinguished from the gall stones, or any artificial compound, by its appearance only : but its effect may be easily counterfeited, by several means,

means, in compositions where it is used, such as the Goa stones, or Gascoign's powder, so as not to be distinguished; whatsoever may have been formerly thought to the contrary. The effect here spoken of is the making testaceous, or other such like bodies, give a yellowish green colour to paper, when rubbed on it; which has been generally esteemed a certain proof, that any composition contained a due proportion of bezoar.

They, therefore, who are desirous to have those medicines genuine, in which the bezoar has a part, must prepare them themselves; or, otherwise, they can never be certain, that they are not imposed upon in this particular.

*Adulteration of gum-resins, gums, and balsams,
in general.*

The gum-resins, and gums, in general, which make so large and important a part of the materia medica, are extremely liable to sophistications, by dissolving them, and, in their reduction to a dry consistence, commixing with them heterogeneous matter, either resembling the gum-resins or gums themselves, or such foulness as is natural to them

from the manner of their production. But, as this admits of a great variety of circumstances, it is impracticable, to lay down any particular rule, for the judging of, or proving, the purity, or genuineness, of such substances. The easiest method is, to compare each kind with a well chosen specimen; by which, the degree of foulness from bodies wholly heterogeneous, or alteration in the apparent qualities by any sophisticating mixture which has greater affinity with them, will be best perceived.

The purification, by solution in the proper menstrua, may be, however, used, where it is of great importance, to know, particularly, the proportion of feculencies, that may be contained in any parcel in question.

The balsam of capivi; as also the Chio, and Venice turpentine are very often sophisticated with the common turpentine; and it is frequently substituted intirely in their place, in compositions.

The balm of Gilead, balsam of Peru, and others of a dear kind, are, likewise, very subject to be adulterated, by mixing turpentine,

tine, or some of the cheaper kinds, with the dearer.

While they are alone, the several species of the terebinthinate genus are distinguishable enough from each other : but, when they are compounded with each other, or mixt with bodies of a different nature, it is very difficult to determine certainly with respect to the genuineness ; any further than can be done, by their peculiar scents ; to judge the better of which, it is always proper to have specimens of such as are known to be good.

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